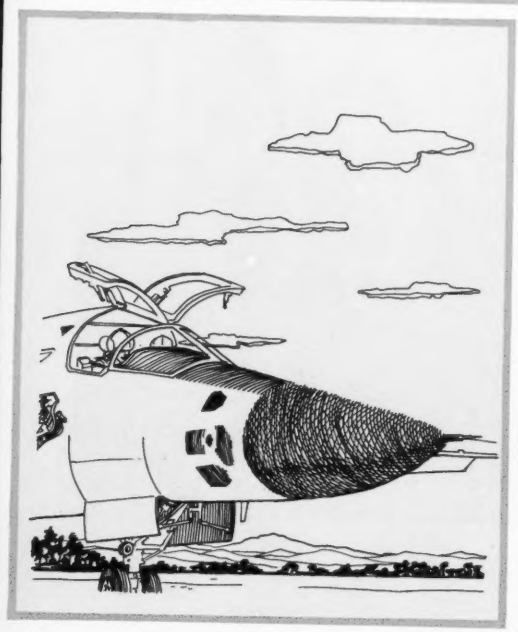
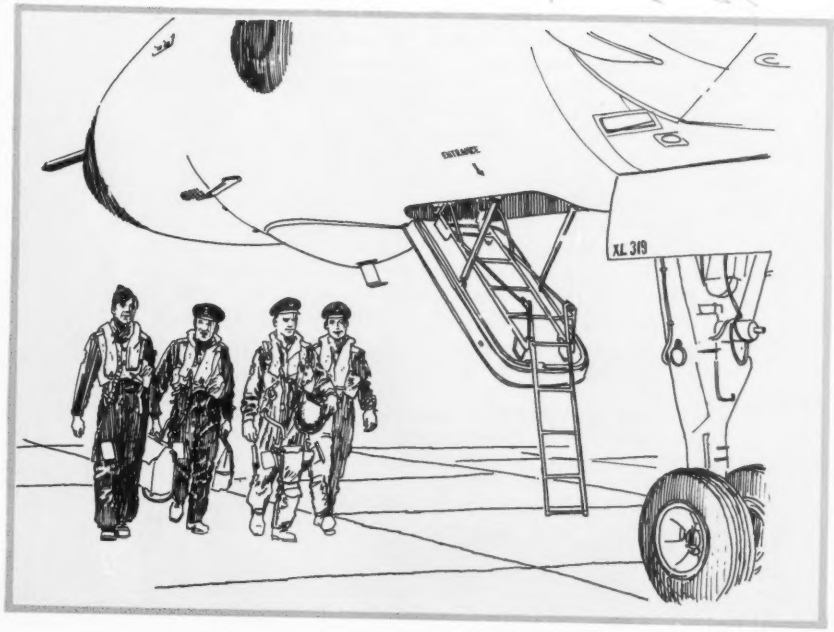
THE NAVIGATOR

AFRP 50-3 Volume XXII, Number 2, Summer 1975





NAV OF NOTE

Colonel Eugene D. Scott is the Commander of the 47th Air Division (SAC) at Fairchild AFB, WA. He is a brigadier general selectee and the first navigator assigned as a commander of a flying unit (the 47th AD includes the 92nd Bomb Wing at Fairchild, the 341st Strategic Missile Wing and other units).

He was born in Thomasville, GA, and grew up there "...raised along with my twin brother and an older brother by our widowed mother who owned and operated the New Russell Hotel, which we, of course, considered Thomasville's finest." Col Scott finished high school in June 1945 as an honor student. In July he entered the University of the South, Sewanee, TN, enrolling in a pre-theology regimen leading to a degree with honors two and one half years later. His major field was Greek, with minors in philosophy and mathematics. "But then, graduating caused my draft deferment to run out, and with the draft board breathing down my neck, I ran, not walked, to Chattanooga and volunteered for the Aviation Cadet Program." But, due to several unavoidable delays (one the requirement to gain 20 pounds in two months to meet the minimum weight standards) and close scrutiny by the draft board, he enlisted, 20 November 1948; finished basic training and then transferred to Randolph AFB. "I. . .changed my olive drabs for Air Force blue and became the lowest life imaginable, an underclassman at the 'West Point of the Air' as it was then known." Col Scott says he learned all sorts of things, but "what I didn't learn was how to fly, —after 110 hours the T-6 and I decided to get a divorce." He subsequently entered navigator training at Ellington AFB, where his luck changed. "For one thing, we were the *first* class of students in the new school, so we were UPPERCLASSMEN for the entire year!" In October 1950 Colonel Scott graduated top man in the class and was commissioned a second lieutenant.

"As number one 'weenie' in the class, I got first choice of assignment and sacrificed myself to the good of the service by taking a 'hardship' assignment to Wiesbaden, Germany. I served as a navigator, primary duty, for such exotic aircraft as SB-29s, SB-17s, C-119s, SA-16s, and H-5H, and I had a ball." During this period he also served as the personnel officer and supply officer, additional duties, 18 months each. He remained with Air Rescue until July 1953 transferring from Wiesbaden to Furstenfeldbruck AB, and subsequently to Wheelus AB, Libya. "I then rotated back to the states to begin my long romance with SAC." At this time he was assigned to the 100th Air Refueling Squadron, Lockbourne AFB, OH, remaining with this squadron through its redesignation and relocation to the 508th Air Refueling Squadron, Turner AFB, GA. "Again, I asked for and got important additional duties, Chief of Personnel, Squadron Executive Officer, and for several years, senior standardization navigator."

In 1967 Col Scott transferred to the 4050th Air Refueling Wing, Westover AFB, flying KC-135s. "...I continued the additional duty route as Chief, Officers Assignment Division, Directorate of Personnel. Later, I left the crew force and became Wing Navigator and Chief, Current Operations Branch. In 1962, I was appointed Commander, 4050th Armament and Electronics Maintenance Squadron,—my first command, and where those 11 years of additional duties really began to pay off!" He served in this capacity for only a few months, and then transferred to a completely new career field—Missiles.

After attending Atlas "F" training at Sheppard AFB, TX, Col Scott reported to the 550th Strategic Missile Squadron, Schilling AFB, KS, in March 1963. He remained with the 550th Strategic Missile Squadron as Chief, Missile Assembly and Maintenance until the base was closed in October 1965. Col Scott was then assigned to the 321st Strategic Missile Wing, Grand Forks AFB, ND, first as a missile combat crew commander, then as Wing Senior Instructor and Chief of Training. In August 1967, Col Scott reported to the Naval War College, Newport, RI, and was a distinguished graduate in June 1968. While there, he completed requirements for a masters degree in International Affairs from George Washington University, again, graduating with honors. From Newport he was assigned to the 345th Tactical Airlift Squadron, Ching Chuan Kang AB, Taiwan, where he again served in the additional duty as Squadron Executive Officer.

Col Scott returned to the United States in March 1970, reporting to Chanute AFB, IL, for Minuteman Maintenance Training, and then to the Ballistic Missile Evaluation Agency, Headquarters SAC. He was reassigned in March 1971 to Headquarters, USAF, where he served as Chief, Missile and Space Operations Branch, Strategic Division, Directorate of Operations. On 20 January 1973, Col Scott was assigned as Commander, 390th Strategic Missile Wing, Davis-Monthan AFB, AZ. He assumed command of the 47th AD, 16 February 1975.

Col Scott is married to the former Joanne Buckner of Albany, Georgia. They have two sons, Braddock and Leslie.

His assignment as Commander, 47th Air Division was announced almost immediately after his selection for promotion to brigadier general. When asked about being the first navigator selected to command a flying organization, he replied, "It is a great honor and a great challenge, not only to me, but to all navigators. If this poor boy from South Georgia can do it, then the way is open for any navigator to equal and exceed this record. The door is open. Now, YOU walk through it!"

COLONEL EUGENE D. SCOTT

THE NAVIGATOR

Volume XXII, Number 2, Summer 1975

UNITED STATES AIR FORCE

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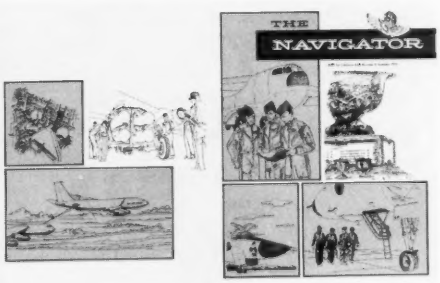
Published tri-annually by Air Training Command with funds approved by Headquarters, United States Air Force. Distributed, in accordance with AF Manual 7-1, through the AF Publication Distribution Center on the basis of one copy for each two navigators.

Manuscript contributions are welcomed, as are comments and criticisms. Contact the Editor before extracting from or reprinting material. Opinions expressed by individual contributors do not necessarily reflect the official viewpoint of the Department of the Air Force. Address all correspondence not pertaining to distribution or subscriptions to:

323 FTW/DNPM
Mather AFB CA 95655
Autovon: 828-2138

THE NAVIGATOR is available on subscription for $3.00 per year domestic, $3.75 foreign, $1.00 per copy, payable and sent to:

Superintendent of Documents
Government Printing Office
Washington DC 20402



AFRP 50-3

CONTENTS

NAV OF NOTE 2

The Strategic Air Command
Bombing and Navigation Competition 5

Navigator Command of Flying Units;
Perspectives and Prospects 11

STC—The Radar's Edge 23

Navwords 24

Cold and Low? Look Out Below! 25

Never Be Late 28

Supersonic at 145 KIAS 29

NAVIGRAMS 31

The cover art for this issue depicts the various aspects of the Strategic Air Command's Bombing and Navigation Competition. Particular emphasis is placed on the multitude of activities, close-knit coordination and team effort necessary in the accomplishment of the Strategic Air Command's mission.

TO THE EDITOR

Dear Editor:

I read Captain Willcox's article with much interest and a great deal of amusement. His humorous way of depicting his dedication and concern for his job show that he is as effective a writer as he is a navigator. As an ex-"SAC trained killer" (B-52 A-C) for 7 years, I can truly appreciate all that Captain Willcox discussed. I hope that my next nav is as "paranoid" as Captain Willcox. After all, if his paranoia keeps him from ending up in a smoking hole, he's saved me too!

Captain Lorne D. Sutherlin
Asst. Prof. of Aerospace Studies
California State University
San Jose, California

You said it all!

Ed.

Dear Editor:

After reading how great navigators are on page 3 of your Winter 1975 issue, I was really disillusioned when I came to the picture on page 31, illustrating the excellent article on RAF navigator postgraduate training. The article mentions flights over the arctic in a Britannia and, although the photo is not captioned, it appears that an attempt has been made to re-touch a photo of a RCAF Argus aircraft to look like an RAF Britannia.

Having spent many thousands of hours flying with some of the world's best navigators in Maritime Command; I am sure none of them would be fooled by such a dastardly attempt at deceit. Obviously, the gentleman who produced such a photo should be drummed out of the navigator corps!

Major D. G. Watson
Base Flight Safety Officer
Canadian Forces Base Trenton
Astra, Ontario

You are right! Here is the explanation. Squadron Leader Steele is a very outstanding, highly competent navigator, and discovered the errors in that photograph immediately! The blame lies with us. The Art Editor did not have a photo on hand and attempted to create one. He tried but obviously was not successful.

Ed.

Dear Editor:

Reference made to the Bicentennial in your note accompanying the Bowditch article prompts this letter. In the event you have not already been approached by the Mather Section, there is an Institute of Navigation Call-for-Papers for an international congress in August 1976. We would certainly welcome mention of the occasion in a future issue of "THE NAVIGATOR." Beyond that you can be a catalyst in soliciting contributions on a theme similar to the American Heritage article. Annals of Air Force navigator and navigation experience must contain many events worthy of presentation to an internationally renowned audience. Your participation and support would be most welcome. Please give it serious consideration. For more years than I care to recall, I have been an avid reader of your outstanding magazine and trust I will remain on distribution for many years to come. Keep up the good work!

Colonel Leonard R. Sugarman
Chief, Plans & Requirements Office
Air Force Special Weapons Center
Kirtland AFB, New Mexico

Thank you for the kind words. We are happy to mention the Call-for-Papers. Those interested may contact Col Sugarman at the above address.

Ed.

Dear Editor:

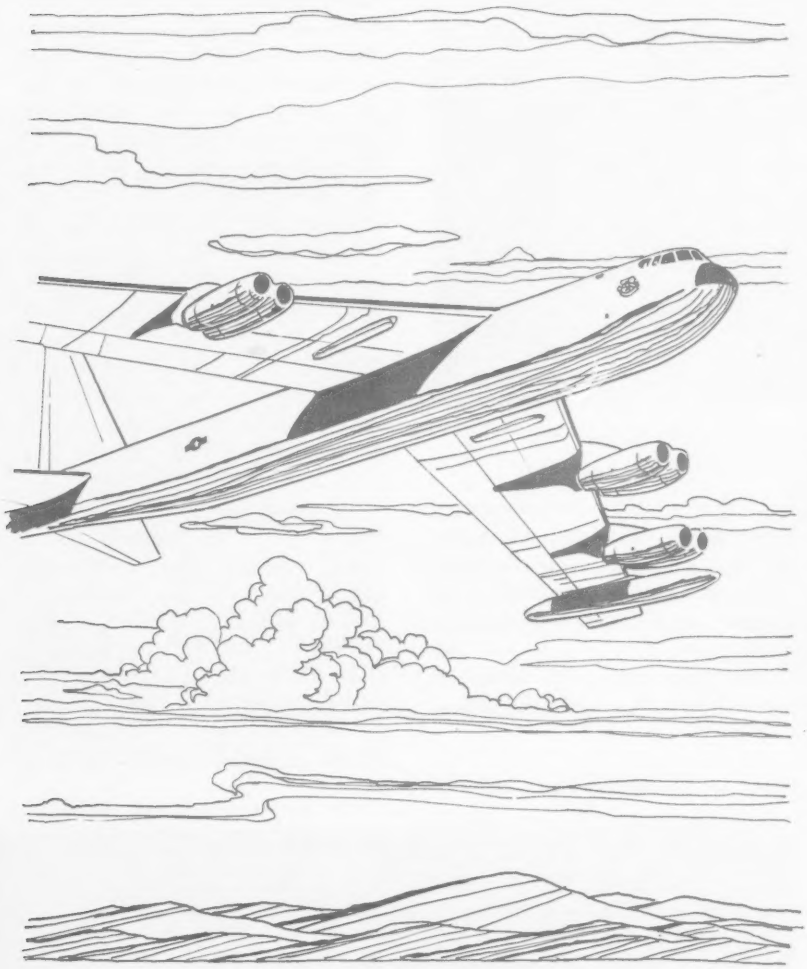
DOTN is pleased to forward for publication the article on the 1974 SAC Bombing and Navigation Competition. We are very proud that SAC navigators are providing you with strong support. I believe this is an indication of the popularity and value of "THE NAVIGATOR" magazine to all SAC navigators. Congratulations to you and your staff for this outstanding publication.

Colonel Anthony Papaneri
Chief, Bomb Nav Division
Directorate of Ops. & Tng.
Headquarters SAC
Offutt AFB, Nebraska

We would like to thank Col Papaneri, Lt Col Nation, and all of the SAC contributors. SAC navigators provide a large percentage of the articles used in "THE NAVIGATOR." Without them, this magazine would not be possible.

Ed.

THE STRATEGIC AIR COMMAND BOMBING AND NAVIGATION COMPETITION



Lt Col Forest L. NATION
Headquarters Strategic Air Command
Offutt AFB, Nebraska

In a welcoming letter to all competitors in the 1974 Strategic Air Command (SAC) Bombing and Navigation Competition, General Russell E. Dougherty, SAC's Commander in Chief, stated: "We in Strategic Air Command are proud to resume the SAC Bombing and Navigation Competition, the 19th in a series, and the first since 1971. During 1972, our 'competitions' were flown in enemy skies against some of the most heavily defended targets in the world. The success of the Southeast Asia bombing operations demonstrated the real meaning and value of our peacetime Bombing and Navigation Competitions. In conducting this peacetime competition, we hone the skills required to maintain a strong deterrent posture and provide our Nation with flexible strategic options in times of crisis and national emergency. This year's competition will again demonstrate the valued capabilities of the manned bomber in the hands of the very best airmen our profession has produced. The skills demonstrated here, the lessons learned, and the experience gained in professional competition will serve as a training ground and example for our worldwide crew force as we go about the deadly serious profession of strategic deterrence."

General Russell E. Dougherty, CINCSAC, welcomes General Robert J. Dixon, TAC Commander

The first "Bomb Comp," as it has come to be known, was held in 1948, only two years after SAC became a separate command. Due to widespread post-war demobilization, the young command had been unable to devote much time to bombing practice. Hoping to improve bombing proficiency, General George C. Kenney, SAC's Commander, scheduled a bombing tournament at Castle AFB. The results of the competition pointed out suspected weaknesses and led to stepped-up training programs. In the 1949 competition, higher bombing scores dramatized the importance of the increased

RAF Vulcan crew arrives for the competition.

training—and the value of the bombing competition.

The outbreak of the Korean conflict in 1950 forced cancellation of the competition that year. SAC crews bettered the peak records of WWII for missions flown and tons of bombs (per aircraft) delivered on target. Moreover, SAC crews proved so adept at radar bombing that they exceeded the expectations of planners in all-weather performance.

The competition was resumed in 1951 and became an annual event for the next ten years. A highlight of the 1951 event was the entry of two Royal Air Force (RAF) crews, adding an international flavor to the competition. Also, the Fairchild Trophy, Bomb Comp's premier award, was established in honor of General Muir S. Fairchild, a former Air Force Vice Chief of Staff.

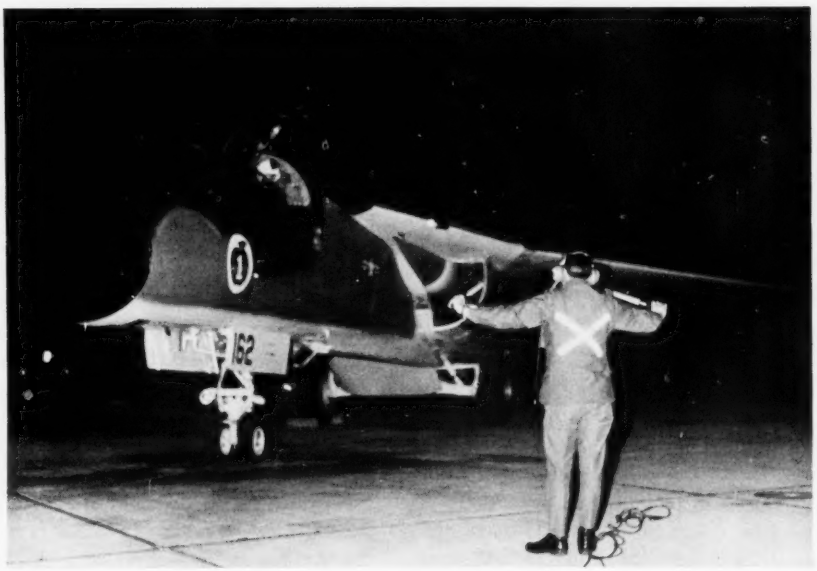
The 1953 competition was especially significant, in that SAC's first pure jet bomber, the B-47, made its debut in the competition, while the B-29 made its last appearance after many years as a tough competitor. The B-50, the B-29 "look-alike," competed for the last time in 1954. An important event at the 1956 competition was the first appearance of the B-52 "Stratofortress," destined to become the workhorse of SAC for many years.

The mammoth B-36 made its farewell to competitions in 1958. In 1959, the Comp was expanded to include air refueling and the long-awaited all-jet KC-135 "Stratotanker" made its first appearance in the contest. In 1960, there were three events of special interest. The B-58 "Hustler" was introduced to the competition; the Saunders Trophy was established for competing tankers; and a B-52 crew took the Fairchild Trophy for the first time.

After the 1961 competition at Fairchild AFB, increased operational commitments forced postponement of the event until 1965.

Recognizing the value of competitions to the command and despite heavy operational commitments, SAC elected to conduct competitions in 1965 and 1966. However, the increasing requirements in Southeast Asia forced frequent interruptions to the competition until 1974. Those years saw many changes in SAC's force. The KC-97s, B-47s, and B-58s were phased out of the inventory and the FB-111 came on the scene. B-52

FB-111 returns from mission.



crews were setting new records daily for tons of bombs delivered on enemy targets. This was especially true during "Linebacker II," eleven days of all-out strategic and tactical bombing of North Vietnam between December 18-29, 1972.

"1974 Vintage Rickenbackers" KC-135 competitors from Rickenbacker AFB.

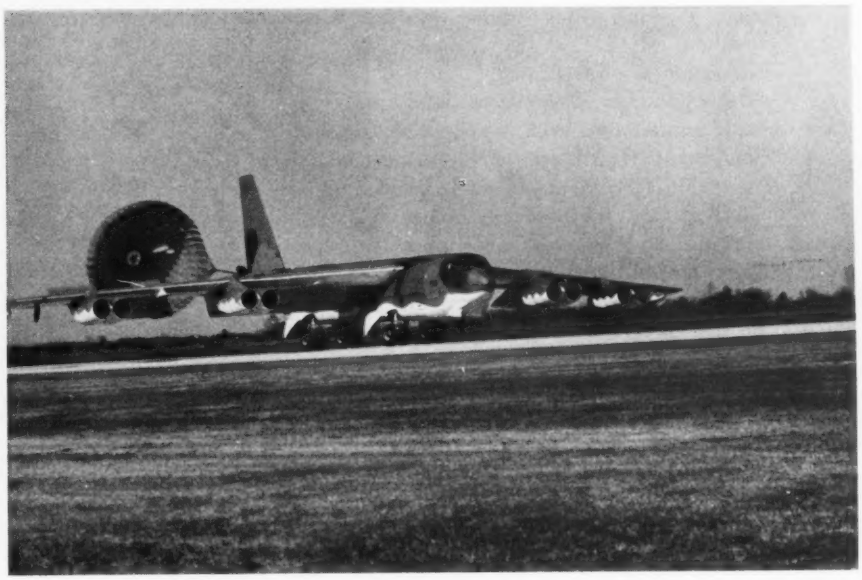
Maintenance teams carefully check and calibrate bomb-nav systems prior to launch.

Fifteen B-52s were lost during "Linebacker II." The William J. Crumm Linebacker Memorial Trophy, named in honor of Major General Crumm (killed in action, 1967), was established to commemorate the B-52 crewmembers who were killed or listed as missing in action during SAC's involvement in Southeast Asia. The trophy was awarded for the first time during the awards ceremony at the 1974 competition.

A highlight of the 1974 competition was the first appearance of Tactical Air Command (TAC) in the SAC event. Two TAC F-111s provided stiff competition for SAC and RAF crews. Also, for the first time, a SAC FB-111 wing won the coveted Fairchild Trophy and an RAF Vulcan crew captured the Mathis Trophy for compiling the most points in combined bombing and navigation.

Each crew flew two night missions during the 1974 event. Bomber crews flew a celestial navigation leg, a high altitude conventional bomb run, and two low level multiple release bomb runs on each mission. Tanker activity consisted of celestial

B-52 lands after final mission.



Scores are posted on the big scoreboard located in the Competition Center at Barksdale AFB.

Tense faces watch as scores are posted.

Throughout the history of the competition, SAC has strived for perfection. In attempting to reach this objective, only the very best aircrews are selected to compete. This is done largely by competitive scoring of regular training flights within each unit. The unit's maintenance team is composed of individuals recognized for superior job performance within their own specialty. Working in a relationship that would seldom be developed under other conditions, air and navigation, a radar precision termination, and an orbit exercise. All activity was scored by Radar Bomb Scoring sites under the direction of SAC's 1st Combat Evaluation Group (CEVG).

How good do you have to be to win a competition? Well, the FB-111 crew from Plattsburgh AFB had a winning Circular Error Average (CEA) of 353 feet for ten bomb releases; an RAF crew averaged 1.6nm circular error on two basic night celestial legs, good enough to win the Navigation Trophy. For all competitors the overall Circular Error Probable (CEP) for bombing was 600 feet. This was achieved on a low level route that proved to be the most difficult SAC crews had flown in several years. The average basic celestial leg CEA was a very respectable 6.48nm.

Smiles reflect outstanding results of RAF crew as scores are posted.

ground crews hone the unit's selected aircraft to a fine edge. Units are encouraged to submit proposals for systems modifications which they believe will improve crew and aircraft capabilities. Many of these local innovations have proven so successful during the competition that afterwards they have been adopted command-wide.

A proud moment as Colonel Louis Buckman, 92 BMW/CC, accepts William J. Crumm Linebacker Memorial from Mrs Crumm and son, Captain W.J. Crumm II.

Representing her Bomb Wing, 2nd Lt Cathi Daniel draws for position in the second bomb run of the 1974 Bomb Comp.

The experience of each crewmember, the intense and detailed study, the many hours of practice, and the all-out effort of each competitor combine to provide an environment which fosters many tangible and intangible benefits. These include improvements to aircraft systems, improvements in bombing and navigation system accuracies, and ideas for improving avionics systems. Further benefits have been derived in operations and maintenance management concepts. Competitions have formed the basis for changes in doctrine, training, tactics, techniques, and approaches to the strategic mission.

These changes and improvements are largely achieved by very thorough and detailed pre- and post-competition study and analysis. Each simulated weapon release and navigation leg is analyzed in detail. Air and ground crew procedures and aircraft performance are studied. Each unit's plan for winning is reviewed and the lessons learned discussed and recorded. The results of this extensive analysis are published in a formal document and distributed to all units.

The competition provides a melting pot of experience, a breeding ground for ideas, and an enthusiastic group of professionals who literally force improvements to surface. "Bomb Comp" continues to provide SAC with a timely tool for keeping abreast of the ever-changing strategic scene and clearly underlines the SAC commitment to maintaining the highest possible level of proficiency in bombing and navigation.

Lieutenant Colonel Forest L. NATION

Lt Col Nation, a native of Greenville, Texas, is married and has two children. He received his commission through the ROTC program at East Texas State University in 1958; completed navigation training at James Connally AFB in 1960; and navigator-bombardier training in 1961. Since that time he has been assigned to the Strategic Air Command.

Lt Col Nation has nine years of B- 52 aircrew experience, and has flown in all series except the "B" model. He has served in a Wing Bomb Nav Branch as the Target Study Officer, and is presently assigned to the Bomb Nav Division, Headquarters SAC. Lt Col Nation is the command project officer of the SAC Bombing and Navigation Competition.

FAIRCHILD TROPHY WINNERS

DATE	BASE	WINNER	NAF	ACFT
1948	Davis-Monthan	Best Unit: 43 BG	8AF	B-50
	Walker	Best Crew: 509 Gp	8AF	B-29
1949	Castle	Best Unit: 93 Gp	15 AF	B-29
	Ellsworth	Best Crew: 28 Gp	15 AF	B-36
1950	Competition cancelled due to Korean War.			
1951	Biggs	Fairchild Trophy: 97 BW	8AF	B-50
	Biggs	Best Crew: 97 BW	8AF	B-50
1952	Castle	Fairchild Trophy: 93 BW	15AF	B-50
	Biggs	Co-honors - 97 BW	8AF	B-50
	Hunter	Best Crew: 2 BW	2AF	B-50
1953	Fairchild	Fairchild Trophy: 92 BW	15AF	B-36
	Fairchild	Best Crew: 92 BW	15AF	B-36
1954	Carswell	Fairchild Trophy: 11 BW	8AF	B-36
	Carswell	Best Crew: 11 BW	8AF	B-36
1955	March	Fairchild Trophy: 320 BW	15AF	B-47
	Castle	Best Crew: 93 BW	15AF	B-47
1956	Carswell	Fairchild Trophy: 11 BW	2AF	B-36
	Lincoln	Best Crew: 98 BW	8AF	B-47
1957	Pinecastle	Fairchild Trophy: 321 BW	2AF	B-47
	Little Rock	Best Crew: 384 BW	8AF	B-47
1958	MacDill	Fairchild Trophy: 321 BW	2AF	B-47
	Fairchild	Best Crew: 92 BW	15AF	B-52
1959	Lincoln	Fairchild Trophy: 307 BW	2AF	B-47
	Pease	Best Crew: 92 BW	15AF	B-52
1960	Altus	Fairchild Trophy: 11 BW	2AF	B-52
	McConnell	Best Crew: 4347 CCTW	2AF	B-47
1961	Robins	Fairchild Trophy: 4137 SW	8AF	B-52
	Robins	Best Crew: 4132 SW	8AF	B-52
1962-64	No competitions held.			
1965	Columbus	Fairchild Trophy: 454 BW	2AF	B-52
	Columbus	Best Crew: 454 BW	2AF	B-52
1966	Homestead	Fairchild Trophy: 19 BW	8AF	B-52
	Homestead	Best Crew: 19 BW	8AF	B-52
1967-68	No competitions held.			
1969	Grand Forks	Fairchild Trophy: 319 BW	15AF	B-52
	Grand Forks	Best Crew: 319 BW	15AF	B-52
1970	Castle	Fairchild Trophy: 93 BW	15AF	B-52
	Minot	Best Crew: 5 BW	15AF	B-52
1971	Kincheloe	Fairchild Trophy: 449 BW	2AF	B-52
	Wright-Patterson	Best Crew: 17 BW	2AF	B-52
1972-73	No competitions held.			
1974	Plattsburgh	Fairchild Trophy: 380 BW	2AF	FB-111
	Scampton RAFB	Best Crew: No 230 OCU, No 1 Group Strike Command (RAF)		Vulcan

NAVIGATOR COMMAND OF FLYING UNITS; PERSPECTIVES AND PROSPECTS

Major General Robert P. LUKEMAN
Assistant Chief of Staff,
Studies and Analysis
Headquarters , USAF
Washington, DC

On Wednesday, 18 December 1974, the President of the United States signed Senate bill 3906, 93rd Congress, an Act *"To amend title 10, United States Code, by repealing the requirement that only certain officers with aeronautical ratings may command flying units of the Air Force."* The Act thereby became Public Law 93-525, repealing section 8577 (Command: flying units) of Title 10, which had provided that:

"Flying units shall be commanded by commissioned officers of the Air Force who have received aeronautical ratings as pilots of service types of aircraft."

That event during the closing days of last year is not news to readers of this periodical. Indeed, many who read these words have studied the history behind this action, and some have been actors in the process by which it came about. This article merely attempts to place the event in perspective, by tracking the high points of the evolution of command policies, and actions which affected them, during the 66 years of military aviation history leading to the most recent change.

Early History

It may well be that the first military "men in the air" in the United States were the forebears of those who later became known as "observers." On 18 June 1861, Thaddeus S. Lowe, a balloonist from New Hampshire, seeking to urge the Federal Government to use balloons for military purposes during the Civil War, made a demonstration ascent, and dispatched to President Lincoln what was probably the world's first air-to-ground telegraph message. Not long afterward, the President approved the creation of an Army balloon corps commanded by Lowe. For two years, observers peered down over the battlegrounds from Lowe's balloons, relaying intelligence to Union Army commanders. This air arm was discontinued in 1863, victim of an unfavorable cost-versus-interest ratio.

The event at Kitty Hawk, North Carolina, on 17 December 1903 was a more direct harbinger of things to come in military airpower. There, Orville and Wilbur Wright completed four flights, the longest lasting fifty-nine seconds, which constituted man's first powered full flight in a heavier-than-air craft. Only four years later, in 1908, U.S. military aviation was born with the acceptance by the Army of its first Wright-built machine. Until 1911, that lone craft comprised U.S. airpower. In March of 1911, after much pleading by the Signal Corps, funds were provided for purchase of five more airplanes. By 1913, twenty-eight aircraft had been bought, but nine had crashed. Eleven of the forty Signal Corps officers trained as pilots had been killed. Feeling neglected and disregarded by higher leadership, the surviving aviators poured their grievances into a round-robin letter directly to Washington, circumventing normal military channels. The Chief Signal Officer decried this disregard of discipline, customs of the Service, and proper officerly conduct. But this plea by aviators was a foretaste of many more to come, as will be seen below. In any case, after generally unsuccessful operations by the Army's 1st Aero Squadron in attempting support of General John J. Pershing's Mexican border campaign in 1916, only two Army airplanes, both non-operational, were left. Congress finally authorized purchase of some 370 aircraft later in 1916, but only sixty-four were delivered.

In the meantime, while U.S. aviation languished, major strides were being made in Europe. When World War I broke out in August 1914, France and Great Britain had about 1,000 combat aircraft; Germany had about 1,200. By the time the United States entered the war on 6 April 1917, the air war in Europe had already seen the use of fighter, bomber, and lighter-than-air combat craft by both sides. As the American Expeditionary Force engaged, the Aviation Section of the Signal Corps consisted of about 130 officers, mostly pilots; about 1,000 enlisted men; and about 250 aircraft. Despite ambitious plans for aircraft design and production in the United States, when the Armistice came in November 1918, forty-five U.S. squadrons were deployed in Europe but not one U.S.-designed aircraft had been used in combat.

The years following World War I were stormy ones for U.S. aviation in general, and military aviation in particular. Debates on airpower spanned both its civil uses and its role in defense, both in the Army and in the Naval Service. Not only were its role, organization, size, and funding support at issue, but the identity and qualifications of those who should command and man Army and Naval aviation were also at the heart of the controversy. The course of the debates, and their outcomes, left their trail in the legislative records of the time. Just before World War I broke out in Europe, a law passed by Congress (PL 63-143, 18 July 1914) regarding the Aviation Section under the Signal Corps included manning considerations, but made no specific provisions for pilots and observers; all were considered aviation officers. Similarly, just before United States' entry into World War I, the Act of 3 June 1916 authorized manpower for the Aviation Section under the Signal Corps, but again made no distinction between pilots and observers. The specific identities of that manpower – as between aviation officers, flying officers, pilots, observers, and non-flyers – however, was to become a central issue once the war ended.

Following the Armistice, General Pershing convened a board of senior officers of the American Expeditionary Force to record lessons of the war. Chaired by Benedict Crowell, Assistant Secretary of War, it gave particular consideration to the organization of the Air Service. At the time, there were many who advocated a separate air arm independent of the Army and Navy. Others wanted Army aviation to remain in that Service, but to be made co-equal with the other combat branches. The Crowell Board did not recommend that the Air Service become

separate and independent. Extended hearings were held by the Congress during the fall of 1919, spanning the entire issue of the future of civil and military aviation, and the role of aviation in the U.S. armed forces. Major Benjamin Foulois – later to become Chief of the Air Service – and others fought against subordination of the air arm to other combat branches of the Army. Commenting to the House Committee considering Army Reorganization, Major Foulois placed the blame upon the Army General Staff, as the policy-making body of the War Department, for what he described as *"...the present unsatisfactory, disorganized, and most critical situation which now exists in all aviation matters throughout the United States."* He lamented America's aviation unpreparedness upon entry into World War I, and decline from its robust status at the war's end in 1918. He decried the domination of military aviation by the ground combat arms of the Army, and charged that Army plans evidenced the intent *"...to effectively keep the practical flying officers in the subordinate grades with no chance whatsoever to have a voice in the formation and establishment of future Air Service policies."* By "practical flying officers," Foulois made it clear that he meant those who had risked their lives flying, in war and peace, during the eleven years since the Army bought its first airplane, seeking to develop it as a military weapon. He recalled that when he had been assigned to fly that first aircraft, and had studied diligently to prepare, Wilbur Wright had said to him, *"Throw your books away and go get your hands dirty on that machine."*

A bill which had been introduced in the Senate (S. 2715) on 4 August 1919 contained provisions which were at the heart of the controversy. It proposed that the Air Service would be manned by detail of officers from the Infantry, Cavalry, Field Artillery, and the Corps of Engineers. It also provided that any such officer below the grade of lieutenant colonel could not remain on such detail for more than four years in any six, except in time of actual or threatened hostilities. Major Foulois testified on these provisions as follows:

"...In other words, this bill places the Air Service under the 'detail' system, which will result in creating a service without permanency and with constantly shifting personnel, who would hardly be in the Air Service long enough to learn the names of all the different tools and instruments (to say nothing of their efficient use) before they, by law, would have to give up their work and try something else. The 'detail' system, if applied to the Air Service, will, in my opinion, soon result in a high state of inefficiency, with maximum expenditure of public funds and maximum waste of equipment."

He went on to point out that if the bill were passed, 191 of the then-existing 193 vacancies in the Air Service in the grades of major through colonel would have to be filled not with "practical flying officers" but by *"...inexperienced colonels, lieutenant colonels, and majors from the Army at large."* Major Foulois opposed passage of the bill on a variety of grounds, but also said that if, despite his opposition, there was the slightest prospect of it ever being enacted into law, it should contain an addition, as follows:

"Provided, however, that all officers above the grade of captain detailed for duty in the Air Service shall be required to qualify as pilots in the Air Service and be required to participate in regular and frequent aerial flights."

Not that Foulois supported "detail" in any form; indeed, given the well-known hazards of flying in those days, he brought the Committee hearing room to a spontaneous outburst of laughter by adding:

"If this clause is inserted I am willing to wager that the grades of colonel, lieutenant colonel, and major in the Air Service will not be very popular with the aspirants from other branches of the service."

In a more serious vein, Major Foulois pointed out that the United States then possessed 5 million well-trained fighting men, and an enormous store of military equipment. *"But,"* he asked, *"where are the aeroplanes and balloons which would be needed? Where are the pilots and observers?" "Wiped out,"* he said, *"through lack of vision."* He also told the Committee that if the Congress ever enacted the "detailing" provisions of the S.2715 bill into law, he believed that the Army would lose about 99 percent of its Regular Army flying officers then on duty in the Air Service, either by requests to be reassigned to their original branches of the Service or by outright resignation from the U.S. Army.

Following months of debate and the lengthy hearings, the Congress passed the National Defense Act of 1920 (PL 66-242, 4 June 1920). It reaffirmed the organizational position of the Air Service under the Signal Corps of the Army. It also provided that not more than ten percent of Air Service officers in each grade below brigadier general could be officers who failed to qualify as pilots or as observers within one year after the date of their detail or assignment to the Air Service. Finally, it stated that *"flying units shall in all cases be commanded by flying officers."* However, it did not define "flying officers."

This by no means ended the debate, on U.S. aviation in general, military aviation more specifically, or on the organization, manning, and provisions for command of military aviation. Between March 1919 and February 1926, no less than 20 major investigations were undertaken regarding the Air Service. Three among them were particularly important. The Lassiter Board, which reported to the Secretary of War on 24 April 1923, recommended a 10-year program for revitalization of the Air Service. The President's Aircraft Board, also known as the Morrow Board, appointed in the aftermath of the crash of the airship "Shenandoah," submitted its report on 30 November 1925, while the court-martial of Brigadier General Billy Mitchell was still in progress (October 1925 - January 1926). It recommended, among other things, changing the status of the Air Service by elevating it to an Air Corps; authorizing a new Assistant Secretary of War for aviation; assigning aviation representation to the War Department General Staff; authorizing two new brigadier generals as deputies to the Chief of the Air Corps; temporary higher ranks for officers above their Regular Army ranks; extra pay for flying; an increase in the number of flying cadets and air reserve officers; and an increase in the use of enlisted men as pilots. The Lampert Committee was a select committee appointed by the House of Representatives of the 68th Congress. Its original purpose was to investigate allegations of mismanagement and excess profits in the U.S. aircraft industry. It reported on 14 December 1925, having found no profiteering; rather, it pictured the industry as near liquidation—going out of business, in part through Government neglect. Its recommendations were similar to those of the Morrow Board with one notable addition. It recommended a single Department of National Defense with co-equal land, sea, and air services.

Following these many investigations, lengthy and heated hearings were again held in the Congress on the subject of the Air Service in 1926. The hearings before the House Military Affairs Committee in the spring of 1926 were particularly lively, in their consideration of the bill H.R. 10827, *"to provide more efficiently for the national defense by increasing the efficiency of the Air Corps of the Army of the United States, and for other purposes."* That bill included most of the recommendations of the Morrow Board, albeit some of them modified. The recommendation of the Lassiter Committee for a single Department of National Defense headed by a Secretary of Defense, with Undersecretaries for Army, Navy, and Air, which had been introduced as H.R. 46 on 7 December 1925, was also debated, but rejected.

The debate on H.R. 10827 included contributions from many notables, including General Pershing and then-Congressman Fiorella LaGuardia. The record showed that on 12 January 1920, Pershing had written that an air force should be established as a separate arm of the service, coordinate with the Infantry, Cavalry, and Artillery, but should not be established as a combatant force distinct from the Army and Navy. The bill provided for an Air Corps with a major general chief, and three brigadier general assistants. It also provided that at least 90 percent of the officers in each grade below brigadier general and at least two of the three brigadier generals would be flying officers. LaGuardia argued that all three brigadier generals should be flying officers. During debate, he asked the question, *"They would not have a brigadier general of Cavalry who could not ride a horse, would they?"* In arguing that position, he warned against the loophole in the bill that would permit one general to be a non-flyer, who might even be antagonistic to the Air Service, and stated his since much-quoted view that:

"...The one thing that is required in the Air Service among flyers is absolute confidence on the part of junior flying officers in their commanding officers. Anything short of that destroys morale. Flying officers will have confidence in their supervisors only if they are flyers."

The bill was passed by the 69th Congress on 2 June 1926 and became PL 69-446[1]. It established the Army Air Corps (allowed one of the three brigadier generals to be a non-flying officer) and contained the provision as additions to Section 12a of the Act of 3 June 1916 (mentioned above) that:

"...Flying units shall in all cases be commanded by flying officers....Wherever used in this act a flying officer in time of peace is defined as one who has received an aeronautical rating as a pilot of service types of aircraft...and also in time of war may include any officer who has received an aeronautical rating as observer."

In 1936, the law was again amended (PL 74-691, 16 June 1936), not explicitly with respect to command of flying units, but with respect to the definition of "flying officers" first set forth in the 1926 law. This legislation was prompted by a decision of the Comptroller General of the United States on 11 November 1935 which interpreted the intent of the Congress as meaning that

[1] *An often overlooked provision of PL 69-446 was its requirement that "on or after July 1, 1929, not less than 20 percent of the total number of pilots employed in tactical units of the Air Corps shall be enlisted men, except when the Secretary of War shall determine that it is impractical to secure that number of enlisted pilots."*

only those officers of the Army who held a rating as pilot of service types of aircraft, who were physically fit and professionally qualified, and who were performing flying duties as pilots alone were "flying officers" within the meaning of the 1926 Act. That being peacetime, all others— including rated pilots permanently or temporarily disqualified for flying duties as pilots (e.g., eyesight), even though rated and flying as observers— were "non-flying officers." During the hearings, the War Department pointed out that while the duties of pilots were well known, those of observers were also important but less well known. The War Department view was that *"it was inconceivable that only the pilot shall be considered as the flying officer while the commander, navigator, bomber, gunner, and communications officer, whose duties are equally essential to the accomplishment of the military mission and whose duties are performed in the air under the same hazards, are nonflying officers, or, as the name implies, ground officers."*

Accordingly, the law of 1936 deleted the portion of the previous law which admitted "observers" to the "flying officers" ranks only in time of war, and narrowed the term "observers" to mean those associated with aircraft, by providing that *"a flying officer in time of peace is defined as one who has received an aeronautical rating as a pilot of service types of aircraft or one who has received an aeronautical rating as an aircraft observer."* However, it further provided that in time of peace no one could be rated as an aircraft observer unless he had previously qualified as a pilot. It further provided *"that any officer rated as an aircraft observer in time of war must subsequently qualify as a pilot before he can qualify as an observer in time of peace following such war."*

To sum up thus far, there has been no legal bar to command of flying units by observers from the birth of Army aviation in 1908 except that, beginning in 1926, observers could only have commanded such units in time of war, since they were defined as "flying officers" only in time of war. Aircraft observers could, then, have commanded flying units all during World War II and until that war was declared terminated on 28 April 1952, except for Public Law 76-795 passed on 4 October 1940. With World War II going on in Europe, and Army expansion impending, the War Department advised the Congress that it did not intend that officers rated as aircraft observers would be trained as pilots as well. Accordingly, two changes were made by the 1940 law as enacted. The peacetime limit on the definition of "flying officers" was removed. The law provided that *"a flying officer is defined as one who has received an aeronautical rating as a pilot of service types of aircraft or one who has received an aeronautical rating as an aircraft observer or as any other member of a combat crew under such regulations as the Secretary of War may prescribe."* Second, it retained the limitation against non-pilots commanding flying units in peacetime and, for the first time in the history of Army Aviation, prohibited by law the command of flying units in time of war by non-pilot flying officers. It provided *"that flying units shall in all cases be commanded by flying officers who have received aeronautical ratings as pilots of service types of aircraft and who are commissioned in the Air Corps, or qualified permanent general officers of the line who have received aeronautical ratings as pilots of service types of aircraft."* Those provisions remained essentially unchanged, even through the subsequent legislation creating a Department of the Air Force, until the amendment signed by the President on 18 December 1974.

Later History; The Naval Precedent

Many of the travails of aviation in its early days in the Army were paralleled in the Navy, but that is another story. In the Naval Service (Navy and Marine Corps), a Naval Aviator is a pilot. In 1922, non-pilot flying officers were given the designation of Naval Aviation Observers (similar to the aviation observers who had been flying in the Army Air Service). They were largely unrestricted surface naval officers temporarily assigned to NAO duty. As air weapon systems became more sophisticated, and the tasks and responsibilities of NAOs became increasingly demanding and important to mission success, the management of the NAO resource in the Navy evolved apace. In 1959, the Naval Service developed a full-term unrestricted line career pattern for NAOs similar to that of Naval Aviators. In 1960, regular commissioned status was opened to NAOs. In 1964, their designation was changed to Naval Flight Officer (NFO) and they were placed on the same aviation career incentive pay basis as Naval Aviators.

Despite these advances in their career status, conditions unique to Naval Service placed NFOs in an anomalous position. Under then-existing law (i.e., 10 U.S.C. 5942, 1926) NFOs were eligible for major operational commands, including aviation commands such as aircraft carriers and seaplane tenders, but were ineligible to command flying squadrons. Thus, as the Navy pointed out to the Congress in 1969, the NFO was unable to demonstrate his ability at the squadron level of command, which is a natural step in the progression toward the more advanced responsibility that was permitted by law. Moreover, the Navy recognized in 1969 that a remedy was needed quickly. When the NFO program was established in 1964, a number of officers from the earlier NAO program were absorbed into it. Those unrestricted aviation officers of the line were

approaching the rank of commander (O-5), and the Navy felt that they should be able to compete for aviation command so as to provide orderly career progression. The problem had grown in magnitude. In the preceding five years only 37 unrestricted line NFOs had been eligible for promotion to commander (27 had been selected). In 1969 thirty were selected; in the following three years, 114 more were expected to be selected. The Navy recognized that without command opportunity, those NFOs would have been unable to compete on an equal basis for promotion to the rank of captain. Accordingly, on 4 January 1969, the Secretary of Navy petitioned the Congress to amend the law to permit NFOs to command naval aviation schools, naval air stations, and naval aviation units organized for flight tactical purposes. (The proposal also applied similarly to NFOs in the Marine Corps.)

During hearings on the bill (H.R. 11548) before the House Armed Services Committee in the fall of 1969, a member asked whether the restriction on NFOs under which the Navy was then operating was not rather arbitrary. Rear Admiral (now Vice Admiral) William D. Houser, then Director of Aviation Plans and Requirements Division, Office of the Chief of Naval Operations, answered, *"Yes, sir, it is. I think the important thing to stress here is we are not giving the Naval Flight Officer anything. We are just removing restrictions. It is sort of a military rights bill, so to speak, for the Naval Flight Officer."* The bill passed, and became Public Law 91-198, 26 February 1970.

Under the 1970 law, the Navy adopted policies that both Naval Aviators and NFOs are selected by Command Screening Boards without differentiation as to aeronautical ratings; Naval Aviators and NFOs are assigned alternately to command of units which operate aircraft manned by NFOs; and when an NFO is in command of such a unit, a Naval Aviator is second in command (Executive Officer). The present author understands that the Navy regards it as desirable that an NFO serve as Executive Officer of such units prior to assignment to command.

The Navy's first non-pilot to take command of an aircraft squadron was selected on 9 June 1972 on the West Coast. The second assumed command of Fighter Squadron 33 (an F-4 Phantom jet unit) at Oceana Naval Air Station in Virginia on 27 June 1972. Since passage of the law, 20 NFOs have completed command as of this writing, 20 NFOs are currently in command, and 65 more have been selected to command.[2] The types of units thus far commanded by NFOs are as follows:

Carrier-Based

2 VF Squadrons (F-4)
1 Heavy Attack/ Recon Sq (R-5)
1 Recon/ EW Sq (GA-6B)
5 Airborne Early Warning Sqs (E-1, E-2)
1 ASW Sq (S-2/ S-3)

Land-Based

3 ASW Squadrons

Miscellaneous

1 Drone Squadron
1 EW Sq (C-130)
1 Training Sq (T-29/ C-117)
4 Naval Facilities (ASW Support, flying mission)

The Navy has over 3,850 NFOs, in a ratio of Naval Aviators to NFOs of about 3.3 to 1. (The Marine Corps has over 650 NFOs; none has yet commanded flying units; they have not yet attained the seniority for command selection.) As of 31 December 1974, there were no flag officer NFOs (there were eight NFO captains; there were about 1,060 Naval Aviators in the grades of O-6 and above).

Ongoing History; Non-U.S. Precedents

The research necessary for comprehensive treatment of command practices in the air forces of other nations has not been undertaken by the present author. He can, however, present some information on the Royal Air Force (RAF), and—through perhaps imperfect recollection—one other case. For more extensive authoritative information, the reader shall have to search elsewhere.

The Assistant Air Secretary in the Ministry of Defence (Air) of the United Kingdom, Air Vice-Marshal D. J. Furner, CBE, DFC, AFC (a navigator himself), has gracisously provided information on the RAF, as has Air Commodore Neville S. Howlett, Commander of the British Defence Staff, Air, in Washington, D.C. Their recollection, as well as my own from World War II service with the Eighth Air Force in England, derives principally from familiarity with Bomber Command during that war. The first pilot was invariably Captain of Aircraft, even though he might be a Senior NCO whose crew navigator was a commissioned officer. In the RAF today, first pilots are generally Captains of Aircraft,

[2] *A captain NFO is scheduled to assume command of an aircraft carrier in July 1975.*

except that navigators or air electronics officers (AEOs) may be Captain in NIMRODs (18 Group) and SHACKLETON AEW squadrons (11 Group); in those units, Captains are selected on the principle of the best man for the job.

Initial recruitment and junior officer strengths in the RAF are in an approximate ratio of two pilots to one navigator. Promotion to all levels is based solely on merit. Officers compete before promotion boards without differentiation as to category. Current strengths in grades of squadron leader and above show pilot-to - navigator ratios as follows:

Air Vice-Marshal	15 to 1
Air Commodore	11 to 1
Group Captain	5 to 1
Wing Commander	3 to 1
Squadron Leader	2 to 1

Regarding unit command in the RAF, posts open to navigators at squadron leader level are Flight Commander and Leader posts in V-Force (bomber), Transport, NIMROD, BUCCANEER, Phantom, and Canberra units, in Nos. 1 (Bomber Command), 18 (Coastal Command) and 46 (Transport) Groups and overseas. At wing commander level, navigators may command squadrons and serve as Officer Commanding (OC) Operations Wings in some areas. At group captain level, RAF policy provides on the one hand that single-engine aircraft stations require pilots in command. On the other hand, a station such as RAF Finningley, at which navigator/AEO training is conducted, is almost invariably commanded by a navigator. Between these two extremes, navigators may be selected on merit for command at non-single engine type stations, but balance is maintained; the RAF avoids concurrent assignment of navigators to both station command and OC Ops Wing at the same station.

The career of Air Vice-Marshal Furner, a navigator as stated above, serves as an illustration of practice in the RAF. His assignments have included OC Ops Wing Waddington (V-Bomber Wing); Station Commander Scampton (Vulcan bomber base); and Air Officer Commanding, Central Reconnaissance Establishment, enroute to his current high post as Assistant Air Secretary. As he puts it, *"Equal careers, equal opportunities works in the RAF."*

As for another case from my own recollection, I can recall how pleased I was to learn during the 1950s that a former classmate of mine at the USAF Air Tactical School in 1948, Major Heink Zielstra of the Royal Netherlands Air Force, had assumed the post of Commandant of the Royal Netherlands War College, even though he was a non-rated officer. Reared in the traditions of the Army Air Corps and the USAF, my pleasure was mixed with surprise when I learned, in later years prior to his retirement, that Zielstra advanced in the RNAF and MOD successively to posts equivalent to our Chief of Staff and finally, Chairman, Joint Chiefs of Staff. Specifics of rating, and indeed possession of rated status, appear to bear less importantly upon job selection in European forces than in our own.

Recent History; The USAF

During and shortly after World War II, a number of occasions arose in which interpretations of the law of 1940, quoted above, were advanced. A notable example derived from a request as to the legal status of then - Brigadier General William F. McKee, who in 1946 was serving as Commander, European Division of the Air Transport Command.[3] General McKee was rated as an aircraft observer, and held AUS (Army of the United States) rank, not permanent rank, as a brigadier general. On 8 October 1946, in a decision by the Air Judge Advocate, it was held that since General McKee was neither a rated pilot nor a permanent general of the line who had been rated as a pilot, he did not meet the qualifications and his command of a flying unit was contrary both to the statute and the Army regulations implementing it.

Another interesting case occurred some years later. A navigator who had been assigned to the Navigation Training Division at Headquarters Strategic Air Command was transferred to the 22nd Bomb Wing at March Air Force Base, California, and assigned as Deputy Director of Operations. This officer, Lieutenant Colonel Charles (Bud) Metz, who had served in B-29s during World War II, was subsequently assigned in early 1951 as Commander of the 33rd Bomb Squadron, 22nd Bomb Wing (the current Air Force Chief of Staff was in the 19th Bomb Squadron of the wing at the time). He remained in the job not more than two or three months, and then was reassigned to Headquarters Fifteenth Air Force at the same base. (His Wing Commander at that time, now retired, states that he was not relieved for cause. The reassignment order came from higher headquarters; perhaps because someone checked the law.)

In any case, inquiries regarding the rationale for excluding navigators in the Air Force from command of flying units picked up in late 1970, possibly stimulated by the removal of the same restriction in the Navy by the law of February 1970. Among the inquirers in late 1970

[3] *General McKee became Vice Chief of Staff, USAF, in 1962.*

and early 1971 was Senator Tower of Texas, at least one of whose requests was stimulated by letters to the Senator from Major General Norris B. Harbold, USAF, retired and living in San Antonio, Texas, and who felt that there was discrimination against navigators in access to operational jobs, attendance at professional military educational (PME) institutions, and in promotions.

In a letter to the Deputy Chief of Staff, Personnel, HQ USAF, dated 31 March 1971, the late Lieutenant General George B. Simler, then Commander, Air Training Command, advised that he had selected an experienced navigator colonel as Vice Commander, 3535th Navigator Training Wing effective upon retirement of the incumbent in June 1971. He pointed out that under existing law, that colonel could not assume command during absences of the Wing Commander, a pilot. Citing the 1970 Navy precedent, General Simler stated that Congressional action was warranted, and recommended moving in that direction. As a result, in the spring of 1971, HQ USAF canvassed commands in the field for their views on whether or not the law should be changed and navigators be permitted to command flying units. Replies from the ten Air Force major commands (eight operational; two support) and two joint headquarters commanded by Air Force general officers tallied as follows (see footnote below):

Operational		Support[4]		Joint		Total	
Yes	*No*	*Yes*	*No*	*Yes*	*No*	*Yes*	*No*
4	4	3	0	1	1	8	5

However, the "yes" views of one of the Air Force operational commands and one of the support commands were qualified, so that while the tally for a change in the law was 8-5, unequivocal support for command by navigators was more accurately 6-7. Of the "navigator-heavy" operational commands, the tally was 3 yes, 2 no; but again, one of the "yes" replies was the qualified one, so that the tally really was 2 yes, 1 yes "but," 2 no. In the summing up, the commanders of the field commands with the majority of navigators assigned had tallied in the "no" column.

The rationale advanced by those in favor of permitting navigators to command flying units argued for letting commanders pick the best man on a case-by-case basis; and identifying billets as "pilot only" or "pilot/nav" and for the latter, picking the best man. Those opposed argued that mission effectiveness would suffer if the Air Force had non-pilot "do as I say, not as I do" commanders; that there were too few opportunities for pilots to command, so navigators should be restricted to command of non-flying units; that leadership would be weakened at a time when the Air Force needed to develop greater professional leadership; and that total knowledge and background for decisions concerning flight operations are gained only through experience and personal exposure, so that it is questionable whether navigators could effectively command in either peacetime or combat environments.

Accordingly, in a response to General Simler on 31 July 1971, the Air Force Vice Chief of Staff advised that the issue had been reconsidered, cited rationale essentially as described above by those opposed, and stated that it was not deemed prudent to initiate a change in the law.

A similar chain of events occurred again in 1973. The then-Commander, Air University Command, on 22 February 1973, forwarded to the Chief of Staff a letter dated 29 January from a colonel navigator addressed to the Chief of Staff, through channels, stating that he would like to compete for an opportunity to command the 3535th Navigator Training Wing at Mather AFB, California, upon his graduation from the Air War College in June 1973. The colonel cited RAF and Navy precedents, stated that the existing policy placed navigators in the only career field where an officer could not command in his primary career area, and cited statistics from a study by another Air University student showing that while the rated force ratio of pilots to navigators was about 2½ to 1, the Senior Service School attendance ratio (colonels) was 12 to 1, O-6 authorizations were 35 to 1, and the general officer ratio was 72 to 1. He also stated that there was only one navigator general for each 3,000 navigators on active duty, and that non-rated general officers outnumbered navigator generals by 9½ to 1. The Commandant of the Air War College indorsed the letter on 12 February 1973, stating that commanders must be assigned who are best qualifed by operational background and experience, and in units with flying missions involving operational command and control of aircraft operations, this would almost invariably be a trained pilot. He further stated that he did not know whether the 3535th Navigator Training Wing might be an exception. In his forwarding letter to the Chief of Staff, the Commander, AU, stated that if the Air Force wanted to test the concept, Mather AFB would be a good place to do it, and that he would not be opposed to such a move. In a response dated 13 March 1973, the CSAF restated to the Commander, AU

[4] *It was really 4-star Air Force generals heading the commands who were queried. ATC and AU, headed by Lt Gens, were not. ATC is included here as a "yes" in view of Lt Gen Simler's letter which prompted the survey. AU's view at that time is unknown.*

the 1971 position on the request by Commander, Air Training Command.

In this same spring of 1973, a group of officers in the 43rd Strategic Wing, SAC, at Andersen AFB on Guam, under the title (perhaps self-conferred; the record available at this writing does not show) Navigator Rated Officers Working Group, published a report detailing navigator grievances, describing Canadian Forces' policy which is similar to that of the RAF, citing new statistics based on the conflict in Southeast Asia (e.g., two of the three fighter aces of that conflict were navigators; more Air Force navigators than pilots over North Vietnam during Linebacker II operations) and favoring a change in policies, including the law restricting command. Not only was this report sent on 18 April 1973 through military channels to the Chief of Staff, USAF, but on 4 June 1973, the junior officer who signed as Acting Chairman of the Working Group sent a copy directly to Senator Stennis asking his support (shades of the neglected 1913 Aviation Service pilots, and Mitchell and Foulois after World War I). On 28 June 1973, Senator Stennis referred that letter to the Department of the Air Force for consideration and reply to him. The Air Force responded to Chairman Stennis on 11 October 1973, explaining that just as the Air Force had traditionally relied on pilots to command its aircraft, so too should flying units be commanded, and reiterated the earlier Air Force position. But other queries appeared. By mid-December 1973, such requests for comment had been received by the Air Force from Senators Thurmond and Javits, Congressmen Hebert and Moss, and Congresswoman Schroeder. Command personnel at the Air University, and senior officers on the Air Staff reported increasing questions to speakers by Service school student bodies and other audiences. Another letter, dated 4 January 1974, was received from Chairman F. Edward Hebert of the House Armed Services Committee. He referred to the earlier negative response by the Air Force, enclosed a letter from the Department of the Navy dated 17 December 1973 to him, and asked that the Air Force furnish him information as to possible accrual of adverse effects should the Air Force provide a unified opportunity for its rated officers to command. The Navy letter, written in response to Chairman Hebert's request, gave the following overall appraisal of the Navy program since 1970 permitting NFOs to command flying units: *"Unified command opportunity for NFOs is viable, credible, and (what's more) really works."*

The Decision

General George S. Brown became Chief of Staff, USAF, on 1 August 1973. In office only several months, he was confronted with the situation described above. He decided to raise the matter for further consideration at a conference of four-star Air Force commanders already scheduled for 18 December 1973. He did so; their consensus was strong opposition to a change in the law. He continued to consider the issue, and to consider the view of others. He brought the same issue up for further discussion at his regular daily staff meeting on 14 January 1974. Major General (now Lieutenant General) Howard M. Fish, then Air Staff Director of the Budget, and a navigator, offered his opinion that the law was not sensible; that whether or not any specific navigator was the person best qualified for a given command, the law stood as a barrier—at best an irritant, perceived by most as clearly discriminatory. In any case, he said, the Air Force should pick the person best qualified. The present author voiced agreement, stating that the problem went deeper than eligibility to command. I pointed out that navigators no longer had the opportunities which I had had on the way up. When I moved up from crew level, both pilots and navigators shared AFSC 1416, Air Operations Staff Officer. I had also held the 0036 AFSC, and served as a Director of Operations. In 1957, navigators began being fed into the Operations Support Officer category (AFSC 1424), a navigator-only AFSC. In the early 1960s, it had been planned to phase out earlier model B-52s by 1969. Accordingly, navigator and electronic warfare officer (EWO) production was cut back. Subsequently, the B-52 early phase-out plan was delayed. It was also decided that navigators would be assigned to F-4 crews. The already existing navigator shortage grew worse, and became further intensified by the Southeast Asia conflict. In 1968 the 1416 AFSC was redefined as "pilot only." Navigators were sequestered in AFSC 1545, Air Ops Officer and AFSC 1516, Air Ops Staff Officer, both "navigator only." In 1973, these were further redesignated as AFSC 22XX, still navigator only. So navigators were limited to operations jobs demanding navigator skills only, and could not get out of those jobs due to the shortage (many senior navigators were extracted from other career patterns and put back on crews). As a result, opportunities for Service school attendance and rated supplement duty were relatively limited. Senior field grade promotions compared poorly with those of pilots and non-rated officers—not because of any bias in the promotion system, but because many navigator career patterns lacked the variety and scope of pilots and others. I offered the view that a change in the law would mean little unless accompanied by navigator career broadening— access to operational staff and supervisory jobs and schooling— through a return to the career management practices prior to the late 1950s, and an increase in UNT output to remedy shortages.

General Brown listened intently to these and other comments offered at that staff meeting. He asked that I provide suggestions on career broadening in writing to the DCS/Personnel (I later did so). He consulted further on the matter later that day with the Vice Chief of Staff.

On 15 January 1974, General Brown instructed the Vice Chief of Staff to set in motion the actions necessary for the Air Force to take the initiative to remove the prohibitive legislation from the books and to broaden the career field for navigators as had been discussed on 14 January 1974. Thus began the removal of laws, directives, and practices which had begun 48 years earlier.

From Decision to Enactment

Once General Brown decided, and secured the support of the Secretary of the Air Force, the legislative process began. On 29 January 1974, the Director of Legislative Liaison, Office of the Secretary of the Air Force, advised Chairman Stennis and Chairman Hebert that while past reviews had resulted in the conclusion that it was not necessary to remove the restriction, it could be viewed by some as discriminatory. Accordingly, the Chief of Staff and the Secretary of the Air Force had determined that initiative should be taken to seek removal of the restriction. The Chairmen were advised that the Air Force would be pleased to work with their staffs in that regard. In a message to all major commands on 2 February 1974, HQ USAF advised of the decision and its notification to the Congress. In early March, the legislative proposal was furnished to the Army and Navy. Their coordination was completed on 2 April. It was forwarded to the House and Senate on 16 May 1974, became Senate bill S.3906, and was passed by the Senate on 16 August 1974. The Subcommittee on Military Compensation of the House Armed Services Committee, chaired by Mr. Stratton, held hearings on it on 18 September 1974, with Major General Ray M. Cole, Assistant DCS/Personnel, HQ USAF, as the Air Force supporting witness. It was passed by a vote of 5 to 1. The full House Committee passed it on 24 September by a vote of 22 to 9 and committed it to the House, where it was passed on 9 December 1974. As stated above, the President signed it into law on 18 December 1974.

Between decision and enactment, an Ad Hoc Committee on Repeal of Title 10 was convened at the Military Personnel Center, chaired by a colonel from DCS/Plans and Operations, HQ USAF. Field commands were represented (and three Navy officers sat in) during meetings on 27-28 June and 29 July-3 August 1974. In anticipation of the change in the statute, the report of the committee recommended that:

1. Air Force policy be that only the best qualified line flying officers will be selected to command flying units. Only the best qualified line officers will be selected for command of other line units.
2. Air Force regulations and directives in conflict with repeal be revised.
3. A single AFSC be established for rated staff and supervisory positions which may be filled by either pilot or navigator.
4. All rated staff and supervisory positions be examined with a view toward redesignating, with the new AFSC, those positions which do not require a specific rated skill.
5. No change be made in policy concerning aircraft commander.
6. Major commands revise/establish procedures to insure all eligible rated line officers are considered in the command selection process.
7. A centralized command selection process for weapon system worlds that require frequent intercommand assignment be a subject of further study.
8. The actions taken to implement the change to Title 10 be given widest dissemination and continued emphasis.

These recommendations were staffed at HQ USAF beginning on 15 October 1974. All staff agencies concurred, although the present author supplemented his concurrence on 21 November 1974 with caveats. I noted that the Army and Navy have centralized command selection boards, but that this was rejected by the committee without a stated rationale. I questioned the justification for separate boards for each weapon world, notwithstanding its intended purpose of avoiding inequity to the F-4/F-111 population due to intercommand movement. Contenders could be identified to a central board in proportion to the force structure. This representative cross-section would closely match Air Force command requirements. It would encourage exposure of selectees to a broad spectrum of Air Force operations, cross fertilize, accommodate officers who had spent time away from operations duties, and avoid inequity to officers in AFLC, AFSC, AU, Air Staff, OJCS, OSD, unified and combined staffs, and similar agencies. This issue is still under study by Air Staff Operations, Personnel, and Programs offices.

Ongoing Actions

Since the repeal, many actions of the kinds recommended by the Ad Hoc Committee are in

progress. The DCS/Personnel, HQ USAF, directed his initial action into two areas: changing directives that conflict with the revised legislation and screening those navigators who may be identified as potential squadron commander candidates. A change in AFR 35-54 (Rank, Precedence, and Command) probably will have been published by the time this is in print, and revisions to AFM 36-1 (Officer Classification) are in coordination. The change to AFR 35-54 deletes the need for a pilot's rating to command operational flying units. The changes to AFM 36-1 will open up to navigators the 0036 (Director of Operations) and 0066 (Air Commander) AFSCs. A new AFSC (perhaps a revised 13XX) for operations staff jobs which can be manned either with pilots or navigators is being considered for inclusion. An extensive revision to AFM 36-23 (Officer Career Management) has already been prepared, and will be published upon finalization of changes to AFM 36-1.

A screening of records by the Military Personnel Center and the DCS/Personnel has identified an initial group of 16 officers possessing an extraordinary degree of potential for command. It is planned that this process will continue. All were selected to lieutenant colonel from the secondary zone and have strong operational credentials. Their names have been passed to their respective commanders for possible consideration in the commander selection process. Action is also under way in the commands. For example, SAC advises that it is in the process of establishing a command review procedure to assist in identifying the best candidates for positions of increased responsibility and eventual command.

Related problems are also being addressed. An Air Staff Flight Management Working Group considered changes to AFR 60-1 in light of the now ongoing phase-out of older administrative support aircraft which afforded flying proficiency opportunities for many "non-force" pilots and navigators. That question is being studied further in the context of the T-39 aircraft which are being retained under the centralized management of the Military Airlift Command. The Aviation Career Incentive Act of 1974 also impacts on rated officer management. The DCS/Personnel and the ACS/Studies and Analysis are collaborating on plans for a major study of that impact, given the competing demands upon rated officers of 11 years of creditable operational flying duty by the eighteenth year of aviation service on the one hand, and of career broadening, schooling, and command opportunity on the other.

Prospects

It is well to remember what the change to the law and actions following from it are all about. It is *not* about permitting navigators to command—or to command operation or combat units—or to broaden their careers. It is about removing the restriction against navigators (and other line officers) commanding *flying* units in peace and war, and broadened career opportunities in the *operations* field.

For example, at the time of the hearings in September 1974, there were about 4,020 commander positions (units) in the Air Force. Only 800 of those were flying unit commands, all commanded by pilots. Of the 3,220 non-flying command slots, 1,110 (35 percent) were commanded by pilots, 240 (7 percent) were commanded by navigators, and 1,870 (58 percent) were commanded by non-rated officers. Based upon officer strengths at that time, only 5 percent of the pilots, 2 percent of the navigators, and 4 percent of the non-rated officers on active duty were in commanders' positions. So while the navigators' share did not compare favorably with those of pilots and non-rated officers, they did then and do now occupy commander positions—and combat unit commander positions as well. In September 1974, six of nine missile wing commanders and 10 of 26 missile squadron commanders were navigators. Moreover, as for careers, there are few career fields in which navigators have not served—and advanced—during the past 30 years.

The problem has been in rated command (none) and supervisory positions (limited); those offering responsibility in the operations field and upward mobility for promotion. And it has been, and still is compounded by a continued shortage of navigators. For example, as of end FY 75, for officers in grades O-5 and below:

- The ratio of pilot-to-navigator requirements is 1.9 to 1. The supply is 2.3 to 1.[5]
- The supply of pilots is 35 percent over the "core" requirement; that of navigators is 15 percent over[5] (pilots have a greater opportunity to flow to "rated supplement and education" categories—more opportunity for broadening into other skills, staff, and management positions, and greater opportunity for training and education).
- Within the rated "core," the "supervision" positions are the more

[5] *The relative ratio and non-core statistics are projected to improve in FY 1976 and beyond as the pilot overage and navigator shortage are alleviated.*

responsible and upward mobile ones. Thirty-three percent of the pilot positions in the core are "supervision," to 26 percent for the navigators. More importantly, for the more responsible lieutenant colonel positions in the "core," 37 percent of the pilot positions are "supervision" to 19 percent for navigators.

Of officers now on board, 9 percent of pilots are colonels, 4 percent of navigators; 0.9 percent of pilots are general officers, 0.08 percent of navigators. The current ratio of pilots to navigators is about 2.4 to 1; in the grades of O-6 and O-7 or above the ratios now are (they have improved vastly—averages since 1950 are given in parentheses) colonels—5 to 1 (14 to 1); general officers—28 to 1 (42 to 1).

It is statistics such as these which the repeal of Title 10 makes it possible to change. But expectations should be realistic. Today, in all grades, 13.5 thousand navigators are eligible to command, but they must vie with 33 thousand pilots, who outnumber them 2.4 to 1. The requirements ratio, now 1.9 to 1, will increase by 1980 (about 2.2 to 1) with navigators phasing off crews in some C-141s and gunships, and possibly in some KC-135s. It will be still greater beyond 1980 with the growth of single-seat F-15, F-16, and A-10 forces. And a far larger percentage of the pilot force than of navigators has had the kind of supervisory and lower level command-related jobs in the operations field which are preparatory for command of flying units.

As a result, the Air Force faces choices. One would be to hasten into the options the repeal provides, by seeking to move sizeable numbers of navigators into command flying units, even though we may lack insight into the correlation between past navigator career patterns and suitability for flying command, and even if this means that we would have to select some whom we were not sure were "the best man." Indeed, some have already counseled an "affirmative action" program. If that means compensation for past inequities through selection of some who are not judged to be fully, or best, qualified, I vote "no." We can neither afford nor tolerate command of any unit—flying or otherwise—by any but our best. And we cannot hope to select our "best" with confidence from the new and enlarged pool of eligibles in haste.

I wish to see navigators succeed—indeed excel— in command of flying units. I do not wish to see failures; to risk having the clock turned back. That is not to say that there are no navigators who are qualified to command flying units right now. I am confident there are, and that some will meet the "best man" criterion. Nor do I expect every navigator selected to be a "perfect" commander (not all flying unit commanders in the past have been), even if I knew what that is. But I counsel for deliberate (read "reasonable") speed. The door to command is open, but there are corridors of operational experience and a waiting room of supervisory preparation that must be traversed before one can pass through it with confidence. Care in initial selections will heighten the likelihood of success; further progress will be built upon those successes; and from there the curve can move upward.

Accordingly, there are burdens upon the Air Force and upon navigators. The Air Force must extend the opportunity for navigators to compete for command of flying units with aircraft in which navigators perform flying duties. It is taking actions now to do so. As I was writing these words, General David C. Jones, the Chief of Staff, made clear to me his sincere and serious intent that Air Force requirements will be met by placing the "best qualified" man in the job. He is confident that this view is shared by commanders and career managers at all levels. (Indeed, CINCSAC selected and General Jones approved the recent assignment of Brigadier General-selectee Eugene D. Scott, a navigator, to command of the 47th Air Division at Fairchild AFB, which comprises the 92nd Bomb Wing (B-52s) at Fairchild, the 341st Strategic Missile Wing (Minuteman) at Malmstrom AFB, and other units. Moreover, General Dougherty, CINCSAC, advised me as this article was going to press, that two lieutenant colonel navigators were recently selected to command significant flying units in SAC; one to command the 328th Bomb Squadron, 93rd Bomb Wing, Castle AFB, California (the combat crew training squadron for B-52G/ H crews); the other, the 3rd Airborne Command and Control Squadron (EC-135s) at Grissom AFB, Indiana.*) The "best qualified" man for flying command now and in the future, as in the past, is identified on the basis of past performance, levels of responsibility, professional and academic schooling, operational background, and dedication to the mission. The burden on the navigator, then, is to strive to become, both in the professional and "whole man" sense, the "best qualified" man. I am confident that many will do so, and earn for navigators an equitable share of command of Air Force flying units.

**Editor's Note: For more information on these officers, see the NAV OF NOTE on page 2 and NAVIGRAMS on page 31.*

STC—the radar's edge

Captain Silvio F. LOMBARDI
62nd Bomb Squadron
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Radarscope interpretation (RSI) and target / offset aiming point (OAP) identification during a low level bomb run can be very difficult to say the least. But B-52 Radar Navigators and those upgrading to the RN position might consider using a valuable scope tuning technique to aid them in their identification process. This technique combines the use of the sensitivity time control (STC) feature of the ASQ-38 Bombing Navigation System with the low altitude ground map (LO ALT GM) radar display mode.

The LO ALT GM mode differs little from the HI ALT GM mode except for one important difference—the LO ALT GM mode incorporates a manually variable sensitivity time control capability. The STC is designed to minimize the over-intensification of short range targets and functions only with the LO ALT GM mode. This mode is highly recommended for use at low altitudes but it may also be used at high altitudes if use of the STC feature is desired.

Understanding the theory behind STC may help in understanding its advantages. We all know that ground map video is developed by amplifying the sum intermediate frequency (IF) signal, which represents the sum total of the entire radiation pattern, and then applying it to a video amplifier in the receiver-transmitter (RT) unit where it becomes transformed into video. The receiver-gain control adjusts the gain of the receiver during this mode of operation and is quite adequate for high altitude flying. However, when we operate the radar set at low altitudes, we lose the desired effect of this video because the energy distribution at low altitudes is much more concentrated and linear control of the receiver gain yields excessively strong returns from close in targets. To remove this undesirable characteristic, an STC signal is used to lower the receiver gain immediately following the transmission of the pulse.

Since most of SAC's B-52 training flights include low level, terrain avoidance (TA) type flying, and since the RN is normally limited to no more than 30nm range on his scope, we shall see how ideally suited the STC feature is for this type of operation. STC is very useful in obtaining a sharp and undistorted short range presentation during low level operation. Further, because the STC operates by varying the receiver gain as an inverse function of range, it has its greatest effect on short range returns and tapers off to a minimum effect on targets beyond 20nm. The STC feature has its own gain control which may be varied manually on a scale from 1 to 10. In the minimum position, brilliance of targets and ground clutter near the center of the scope is at a maximum. As we increase the STC, the amplification, or gain, of the short range returns relative to the distant returns is decreased, resulting in a more uniform video presentation of targets over the entire scope range. By properly adjusting the STC control to reduce blooming of the short range video you allow yourself the benefit of using increased receiver and video gain to tune in the long range, weaker returns. The result is more time for the RN to acquire and positively identify the radar return he is looking for. It provides him with an "edge." We all realize how critical time becomes once we depart the initial point (IP) and proceed in on the bomb run. We all can appreciate the value of the few additional seconds which we can use for RSI and proper target identification. Using and developing proper STC technique can give us those few additional seconds and could easily mean the difference between a good bomb score or a bad one.

As with most any other technique, using STC has one inherent danger. You must remember to decrease the STC control as you decrease your scope range and target scale. Otherwise, you could conceivably blot out the return itself. Experience tells us to initially use an STC setting of approximately 6 or 8 for a scope range of 20 to 30nm, and then gradually decrease it as your range decreases so that at bomb release your STC setting should be about 1 or 2. You would defeat your

purpose by setting in 6 at the IP and leaving it there for the duration of the bomb run. Chances are that you would lose the return completely by 150 seconds to go. However, once you are aware of this danger and can discipline yourself to use proper tuning technique, there should be little problem with using STC at low level, especially on the bomb run.

The main advantage then of using STC is that it gives you a more uniform scope presentation of video by eliminating blooming and allows you more time to find and positively identify the target / OAP on a bomb run. This added time can lead to a smoother bomb run and better bomb scores. "STC, It's The Radar's Edge."

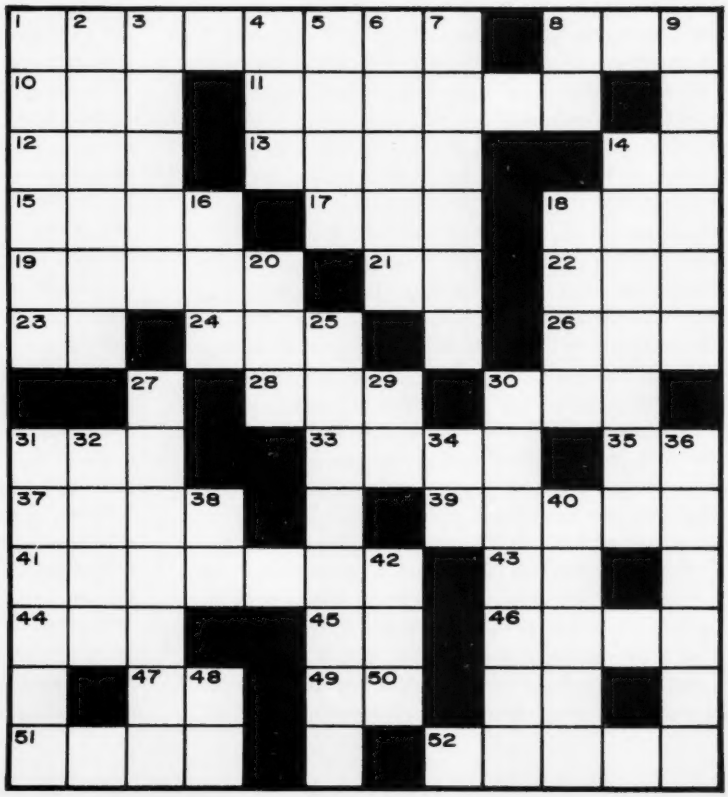
Captain Silvio F. LOMBARDI

Captain Lombardi entered the USAF in 1965 as a Weather Officer assigned to Andersen AFB, Guam. Later, he attended UNT, receiving an Aeronautical Navigator Rating in June 1969. After completing CCTS, he was assigned to the 2nd Bomb Wing, Barksdale AFB, LA. He is presently a Radar Navigator with 2200 hours in the B-52. He has been awarded the Distinguished Flying Cross plus the Air Medal with five oak leaf clusters.

Navwords

ACROSS

1 Type of projection
8 Ultra high frequency
10 Constellation meaning altar
11 Radar beacon transmitting radial line on PPI
12 Unhappy
13 Imitated
14 Height observed
15 Former Russian ruler
17 The self
18 Japanese money
19 Weird
21 Amplitude modulation
22 Devour
23 Abbreviation for railroad
24 Weather phenomenon
26 Aerial delivery system
28 Direction
30 Prefix meaning three
31 Seventeenth letter of Hebrew alphabet
33 Above
35 Abbreviation for Nova Scotia
37 Persian Gulf country
39 Distance from target
41 Exercise authority over
43 Abbreviation for north
44 Time over target
45 Symbol for sodium
46 To inspect or examine your information
47 River and Gulf in Russia
49 Inspector General
50 Part of to be
51 Type of icing
52 What autopilots do



DOWN

1 Every Loran chain has one
2 Navigator's tool
3 Electronic fixing aid
4 Approach using 3 down
5 Used for recording radio calls
6 Long range radio fixing aid
7 Where radar R/T unit is usually found
8 Abbreviation for an allied country
9 Warm, cold or stationary
14 True, magnetic or compass
16 Reduction of personnel
18 Twelve month period
20 Long period, age
25 Type of projection
27 Name for F-4
29 Abbreviation for wind vector
30 When celestial body goes from rising to setting
31 Constellation meaning "easel of painter"
32 Humorous slang suffix
34 In chemistry, erbium
36 Type of radar scan
38 Abbreviation for knot
40 Radio wave interference
42 Characteristic of pressure altimeter
48 To exist, live

NAVWORDS answers on page 30

Captain Richard H. HOBBIE
441st Bomb Squadron
Mather AFB, California

You received clearance from Center to descend to 15,000 feet and have religiously reset the current altimeter setting before leaving FL 180. As you level off, after making the required calls every 1000 feet within 5000 feet of your new altitude, the radarscope seems to start blanking. The aircraft is straight and level. Even so, the blanking worsens, looking peculiarly like a giant mountain shadow.

Fortunately, there is a sudden break in the weather. A somewhat higher than average-pitched voice breaks interphone silence exclaiming, "CLIMB, *CLIMB!*"

A minute more of IFR conditions and that worst of all cloud formations, "Rockocumulus," would have claimed another victim. Some of the most scenic areas owe their aesthetic appeal to mountains. Mountains provide us with ski slopes, challenging places to explore, and many other highly desirable forms of recreation. However, your day will be ruined if you fly into one.

All of us work hard at staying on course and mission timing, but there is another highly important dimension demanding equal, if not greater concern. This "third dimension" is known as altitude.

Like happiness, altitude can mean different things to different people, and sometimes, different things to the same people. The confusion most often arises because there are several kinds of altitudes, each related to another. Every navigator very carefully and thoroughly studies this subject during UNT, but a quick review of it should help to clear any cobwebs lurking in the gray matter of some of us "old heads."

Assuming negligible instrument error, *pressure altitude* is what you read when 29.92 is set in the Kollsman window of your altimeter. Atmospheric pressures vary greatly with location and/or time. These differences must be referenced to a common index before we can express them in workable relationships. For this reason, an average of all the variations was made to derive the standard atmosphere.

The standard atmosphere is based on the assumption that atmospheric pressure will support a column of mercury 29.92 inches high at sea level. Another important assumption is that atmospheric pressure and air temperature decrease at a regular rate commensurate with an increase in altitude. Assuming these conditions, an increase in altitude of 1000 feet corresponds to a one inch fall in atmospheric pressure. This is known as the "standard lapse rate."

True altitude is defined as the height above mean sea level. The only way pressure altitude can ever equal true altitude is for actual atmospheric conditions to equal those of the standard atmosphere. Why then do we concern ourselves with pressure altitude?

We use pressure altitude because it is a very convenient way to standardize altimeter settings where aircraft separation is of primary concern. All aircraft climbing through the transition level, or altitude, have their altimeters referenced or "set" to 29.92.

Because aircraft altimeters must also be standardized below the transition altitude, and a need for terrain clearance exists in terminal areas, local altimeter settings are used. We must understand how these altimeter settings are derived in order to learn what they will and will not do for us.

A weather observer carefully measures the actual atmospheric pressure, then converts his station's elevation (measured above sea level) into inches of mercury using the standard lapse rate. These two figures are added together to compute the altimeter setting.

The altimeter indicates *computed true altitude* when this figure is set in the Kollsman window. Its reference now becomes the measured station pressure converted to sea level by the standard lapse rate. The pressure values to which the altimeter can be set also correspond to the standard lapse rate. Therefore, the altimeter will indicate station elevation when it is physically located there and has been set to the station's altimeter setting.

Instrument approaches would be a nightmare without altimeter settings. Unfortunately, they are only accurate for terrain clearance at their stations, as they are not corrected for the non-standard air temperatures which often occur as altitude increases.

What we need is a means of establishing true altitude under all atmospheric conditions. This can be done by using "D" values. "D" values are the actual differences measured between true and pressure altitudes regardless of location or altitude. True altitude is always equal to the pressure altitude plus the "D" value. When 29.92 is set, all we have to do is add the "D" value to the indicated altitude. But what about situations where the altimeter is not indicating pressure altitude?

We can reference the altimeter to pressure altitude by determing the difference between what is indicated on the altimeter and pressure altitude. This difference is the PAV or Pressure Altitude Variation. It is computed by subtracting 29.92 from the altimeter setting and converting the remainder into feet. Pressure altitude can then be found by subtracting PAV from indicated altitude, and then the "D" value can be utilized.

If the altimeter setting was 30.12, PAV would be (30.12-29.92 inches) X 1000 feet/inches or +200 feet. This means the indicated altitude is 200 feet above the pressure altitude, or more usefully stated, the pressure altitude is 200 feet below the indicated one.

When the "D" value is equal to PAV, indicated altitude equals true altitude. This condition generally exists only at the station. Suppose the station's elevation in the previous example is 300 feet above sea level. The altimeter indicates 300 feet when it is set to 30.12. Hence, indicated and true altitude here are equal. If 29.92 were set, the altimeter would indicate it was 100 feet above sea level. Therefore, the "D" value is also +200 feet.

When PAV and the "D" value are not equal, the indicated altitude is incorrect by an amount equal to their difference. This error can be found by subtracting PAV from the "D" value. True altitude can now be determined by adding this error to indicated altitude.

The above relationships can readily be seen when expressed in the following equations: by definition,

1. true altitude - (pressure altitude) = "D" value *hence,*

2. pressure altitude = true altitude - ("D" value) *also,*

3. PAV = (current altimeter setting - 29.92 inches) X 1000 feet/inches *and,*

4. PAV = indicated true altitude - (pressure altitude) *hence,*

5. pressure altitude = indicated true altitude - (PAV). *Combining 2 with 5 yields,*

6. true altitude - ("D" value) = indicated true altitude - (PAV) *therefore,*

7. true altitude = indicated true altitude - (PAV) + "D" value.

Now, let's use these equations in a hypothetical situation to get a better understanding of what they represent.

At Base X, the altimeter setting is computed to be 29.72, thus yielding a PAV and a corresponding "D" value at the station of -200 feet. An aircraft desires to pass over Base X at 10,000 feet above sea level. The "D" value *at this altitude* is +200 feet.

If the altimeters were set to 29.92, the indicated altitude of 10,000 feet would be 200 feet less than the true altitude. But Base X's altimeter setting is used instead. It is as though the altimeters were "told" the "D" value is -200 feet. However, the "D" value is really +200 feet. Therefore, the altimeters are now indicating a true altitude 400 feet too low. The true altitude is actually 10,400 feet.

The most dangerous situation can arise when there is a "high" at the station but a "low" at aircraft altitude. The surface high results in a higher altimeter setting than standard.

For example, imagine that the "D" value at 15,000 feet is -400 feet. The present altimeter setting is equal to the standard value of 29.92. Under these circumstances, an aircraft would have a true altitude 400 feet lower than what is indicated on the altimeters.

Suppose this same aircraft receives a new altimeter setting of 30.12, but the "D" value does not change. The pilot is very carefully maintaining his assigned altitude. This new altimeter setting causes his altimeter to read 200 feet higher than it did before, so he *descends* to get back to 15,000 feet. Obviously, the terrain clearance problem is worse by 200 feet instead of better as some of us would be inclined to believe.

- (PAV) + "D" value can also be determined from the graph in Figure 1. Some navigators prefer graphic to arithmetic solutions, but the graph is also useful to get a mental picture of how various PAV and "D" values affect true altitude.

We seldom think about "D" values unless we are flying pressure pattern, entering a low level route, or computing ballistics. You probably won't have a current "D" value every time a terrain clearance problem arises.* However, you can check with METRO for forecast low pressure areas along your route and near your alternate airfields. This information, when used in conjunction with the latest altimeter settings and terrain heights, will give you a fairly good idea of where you might get into trouble.

The poorest flying weather is usually during the winter months. Since instrument meteorological conditions are very often associated with low pressure areas, (regions with negative "D" values) be wary of high altimeter settings especially when you are IMC. In other words, if it's cold, and you are low, LOOK OUT BELOW!

** Editor's Note: The new AFM 51-40 provides a method to help here. You can use temp (at altitude), PA, and ITA to compute TA. Comparisons between this method and the use of actual "D" values obtained on overwater missions are very favorable. For more information, read Computer Altitude Solutions, AFM 51-40, p. 4-18.*

Captain Richard H. HOBBIE

Captain Hobbie is from Tulsa, Oklahoma. He entered UNT after receiving a commission via ROTC. He completed NBT in December 1969 and was assigned to the 441 Bomb Squadron, Mather, AFB. Captain Hobbie has over 2,000 hours in the B-52. Over half of it is combat time acquired during ARC-LITE and BULLETSHOT operations. He has an Air Medal with si. oak leaf clusters.

EXAMPLE

GIVEN: Indicated altitude 10,000
Altimeter setting 30.22
D value -120

FIND: Correction and True altitude

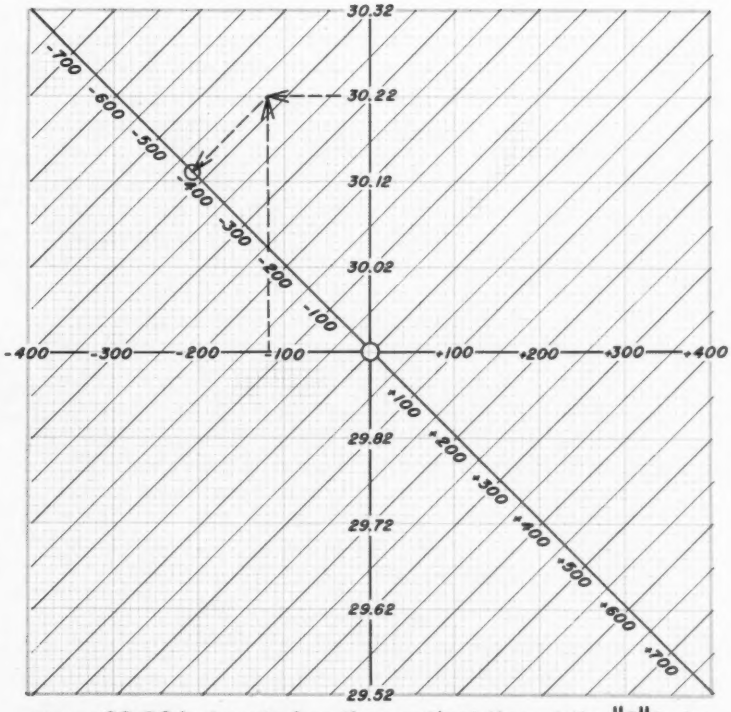
1. Find intersection of the horizontal and vertical lines representing the altimeter setting and D value respectively.

2. Trace the diagonal line running through this intersection back to the correction line and obtain the correction to indicated altitude.

3. Add correction to indicated altitude to obtain true altitude.

4. Subtract correction from desired true altitude to find indicated altitude.

From the graph, the correction is: -42
True altitude = 10,000' - 420' = 9,580'



Note: 29.92 is located on the vertical line at the "0" index

Figure 1

NEVER BE LATE

Captain Dennis REDDING
93rd Bomb Wing
Castle AFB, California

One of the first bits of advice that each new navigator receives concerning controlling time is—"Never Be Late." Generally, time is easy to lose inflight, but difficult to gain. If a navigator has doubts as to the wisdom of this advice, he becomes an instant believer the first time he finds himself three minutes late on a straight leg to a control point with 60nm to run. In a B-52 or KC-135 type aircraft with a groundspeed of 445K he finds he needs to increase the groundspeed to 715K to make his control time. At times like this, navigators wish all aircraft were modified with variable sweep wings!

Once the necessity for never being late is driven home by an inflight experience, many navigators solve the problem by continually arriving early at their control points. They then turn to the reduced airspeed method to control time. However, the airspeed limitation is still present, just on a different end of the spectrum. Flying at near stall speed seems to upset most pilots, and the whole reason for controlling time, anyway, is to arrive at a designated point on time, still airborne.

AFM 51-40, Chapter 25, suggests several methods to lose time inflight including s-turns, double drifts, and the 60° turns. Each of these methods requires a specific alter from the inbound course which must be held for the desired amount of time followed by a correction back to course. Each of these methods is excellent for losing small amounts of time rather quickly. Which one of the methods should be used inflight is dependent on several variables. These include: required time loss, time available to complete the maneuver, and amount of maneuver space available for off course deviations.

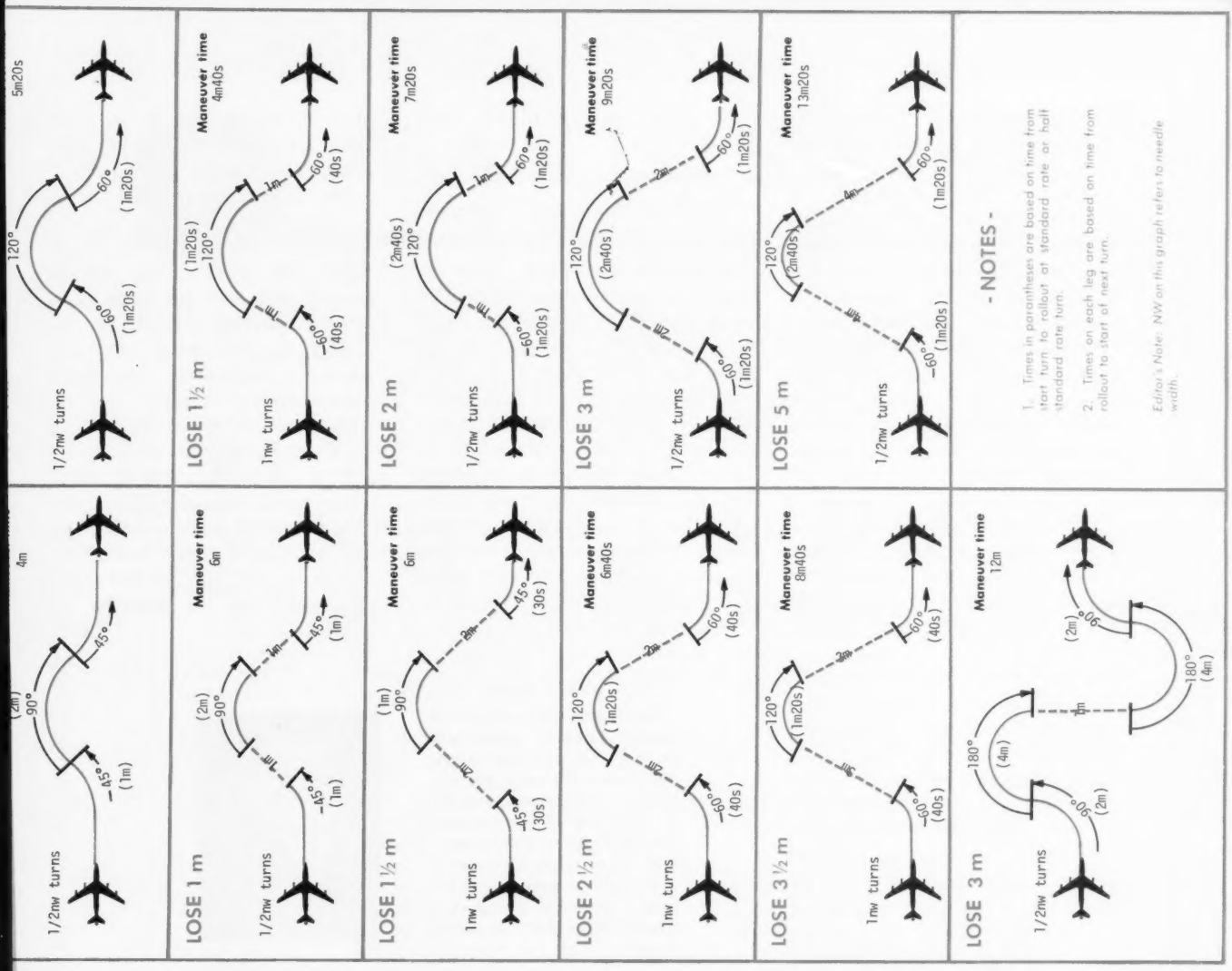
The navigator must first determine which maneuver would best suit his particular time problem and then take appropriate action.

To aid the navigator in his decision, the following chart has been constructed and incorporates all three maneuvers. The entering arguments are desired time loss and time required (or available) to complete the maneuver. These are "no wind" charts, so when using them, the navigator should consider both wind direction and velocity. Turns into a strong wind will require smaller off course deviations. Additionally, turn rates of one and one-half degrees per second or greater may (on some aircraft) degrade the navigation equipment for a short period after the maneuver. Above all, don't forget to obtain proper clearance before initiating any of these maneuvers.

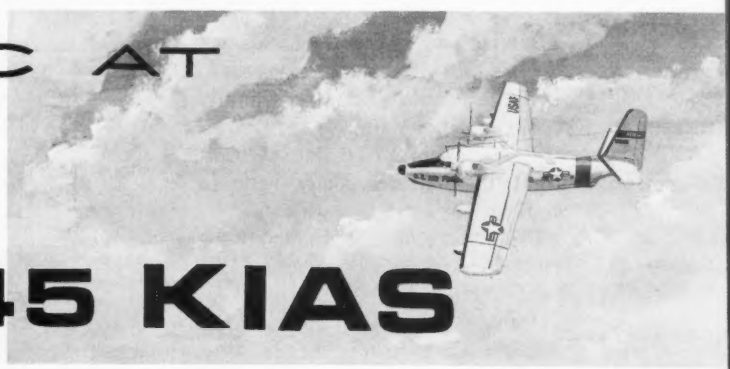
We all realize that there is no magic formula that will apply to all situations. However, a thorough evaluation of where you are with respect to your flight plan and a working knowledge of these charts can assist you in reaching that specified point precisely on time. And isn't that what navigation is all about?

Captain Dennis REDDING

Captain Redding entered the Air Force in 1962 and in 1964 received his commission and wings through the Aviation Cadet program. With the exception of a short tour in B-58s, his flying experience has been in a B-52. He has flown over 300 combat missions and was awarded a DFC in 1968. Captain Redding is presently instructing in the B-52 CCTS at Castle AFB, CA. California.



SUPERSONIC AT 145 KIAS



Major Conal J. BRADY, Jr.
95th Strategic Wing
Goose AB, Canada

I have the distinction of being the only Navigator Instructor / Evaluator in the United States Air Force qualified in one of our most unique aircraft fleets. The primary reason for my selection in this highly competitive area is the fact that the entire fleet (both aircraft) is based at my present duty location. Our navigator force consists of two individuals, one Lieutenant Colonel and one Major. Since the Lieutenant Colonel was a non-volunteer, and we needed an Instructor / Evaluator, the competition was not exactly keen.

By now you have probably guessed that the aircraft to which I am referring is not an unannounced flying prototype of the B-1 or the late lamented F-12B interceptor, longed for by the Aerospace Defense Command. It is none other than the HU-16B Albatross or "Hummie." The local "Hummie" designation is obvious since the engines do not produce a quiet hum.

The navigation equipment available includes the N-1 compass system, periscopic sextant, AN/

APS-31A search radar, AN/APN-21 TACAN, AN/ARN-14 VOR and the ever-reliable Eastman Kodak B-5 driftmeter. This equipment is integrated by the manual/electronic semi-active, navigator guessomatic brain-box. Redundancy is provided through the Mark I visual sensor system (eyeball). The Mark I sensor system is coupled to the guessomatic brain-box computer which provides intermittent aural (oral) and/or graphic outputs which vary between accuracy tolerances of reasonable and questionable.

The average mission altitude is 5-8M ASL at an air speed of approximately 150-170K. Mission duration is anywhere from one to four hours and can cover up to 500 miles. The longest standard training mission we fly is Goose Bay to Argentia Naval Station which is located near the southeastern tip of Newfoundland Island. This mission is about 450nm, with few navigational aids and some overwater time thrown in for good measure. Although this mission is not overly complicated for an experienced semi-low/slow navigator, it can prove a challenge for a 35,000 feet, 450K flyer. At the altitudes we fly, our search radar can provide adequate targets up to 8-10nm but scope interpretation is still the key, as in all radar navigation. Inaccurate maps and constantly changing lake patterns, plus snow and ice distortion from seven to eight months per year, help to confuse the Mark I sensor and the guessomatic computer which are the most indispensable components of the "Hummie" semi-manual aerospace navigation system. The steering package of the HU-16B closely resembles the semi-manual navigation system, in that the key sub-system is composed of a visual sensor, brain-box computer and a servo-component with terminus in two five-digit extremities. The steering system produces varying tolerances which fluctuate around ±10° with no established wave pattern.

Although a navigator is not really required on short range "flag pole" missions, they have proven to be indispensible on longer flights. A local tale, the authenticity of which I have been unable to establish, helps to illustrate this proposition. As the story goes, a few years back one of the Hummies made a flight from Goose to one of the southern bases, I believe it was Loring AFB in Maine. After considerable scenic excursions enroute, a landfall was made and as the aircraft reached the chocks, props turning smoothly on the proverbial fumes, the Wing Commander was heard to remark, "This is the last %#‡°9 time I let one of these †#%‡!& birds fly out of the local area without one of those Z!X&?†¢ navigators on board."

The future of our little HU-16 fleet is somewhat unsure, however, it is reasonable to forecast that the "Hummies" from Goose will be making their final Air Force flight sometime during FY 75. At this writing, no one knows for sure whether they will join their contemporaries resting in the Arizona sun, or fly for awhile with some other organization. Wherever the old '16s go they will be fondly remembered by those who served at "The Goose." I know one little guy who will miss them very much. He is only three years old, but thinks it is just great that his dad flies the "Hummie."

Major Conal J. BRADY, Jr.

Major Brady graduated from St. Joseph's College in Philadelphia, Pa., with a B.S. in Political Science, and holds a Masters Degree from USC. A master navigator having spent eight years in Air Defense Command flying F-89Js and F-101Bs, he has also served on KC-135s. He is presently Chief of Current Operations Division, 95th Strategic Wing (SAC), Goose Bay Airport.

1 M	2 E	3 R	C	4 A	5 T	6 O	7 R		8 U	H	9 F
10 A	R	A		11 R	A	M	A	R	K		R
12 S	A	D		13 A	P	E	D			14 H	O
15 T	S	A	16 R		17 E	G	O		18 Y	E	N
19 E	E	R	I	20 E		21 A	M		22 E	A	T
23 R	R		24 F	O	25 G		E		26 A	D	S
		27 P		28 N	N	29 W		30 T	R	I	
31 P	32 E	H			33 O	V	34 E	R		35 N	36 S
37 I	R	A	38 K		M		39 R	A	40 N	G	E
41 C	O	N	T	R	O	42 L		43 N	O		C
44 T	O	T			45 N	A		46 S	I	F	T
O		47 O	48 B		49 I	50 G		I	S		O
51 R	I	M	E		C		52 S	T	E	E	R

Answers to NAVWORDS puzzle from page 24

NAVIGRAMS

HAYS AWARD: COLONEL ROBERT O. MC CARTAN, DEPUTY COMMANDER FOR NAVIGATOR TRAINING, MATHER AFB, CALIFORNIA, HAS BEEN NAMED RECIPIENT OF THE PRESTIGIOUS NORMAN P. HAYS AWARD FOR 1975. THE AWARD HONORS COLONEL MC CARTAN'S MANAGEMENT IN THE DEVELOPMENT OF THE NEW UNDERGRADUATE NAVIGATOR TRAINING SYSTEM CURRENTLY BEING IMPLEMENTED AT MATHER. EACH YEAR THIS INTERNATIONAL AWARD IS PRESENTED TO AN INDIVIDUAL ENGAGED IN NAVIGATION IN INDUSTRY, CIVIL SERVICE, OR IN THE MILITARY. SPONSORED BY NORTH AMERICAN ROCKWELL AND PRESENTED BY THE INSTITUTE OF NAVIGATION, IT RECOGNIZES OUTSTANDING ENCOURAGEMENT, INSPIRATION, AND SUPPORT CONTRIBUTING TO THE ADVANCEMENT OF NAVIGATION. ESTABLISHED IN 1965, THE AWARD WAS NAMED IN MEMORY OF COLONEL NORMAN P. HAYS, WHOSE AIR FORCE CAREER INCLUDED WORK IN THE DEVELOPMENT OF EARLY NAVIGATION TRAINING COURSES, AVIONICS EQUIPMENT DEVELOPMENT AND SERVICE AS THE NAVIGATOR FOR GENERALS CURTIS LE MAY AND NATHAN TWINING. COLONEL MC CARTAN'S NOMINATION READS IN PART, ". . . HIS OUTSTANDING FORESIGHT, ENTHUSIASM, EXPERTISE, SUPERVISION AND MANAGEMENT HAVE BEEN DIRECTLY RESPONSIBLE FOR THE FORMULATION OF THE FIRST COMPLETE UPDATE OF THE U.S. AIR FORCE NAVIGATOR TRAINING PROGRAM DURING THE HISTORY OF THE AIR FORCE. HIS BRILLIANT INSIGHT INTO THE FUTURE OF NAVIGATION AND SUPPORT RESULTED IN THE ACCEPTANCE OF A PROPOSED UNDERGRADUATE NAVIGATOR TRAINING SYSTEM (UNTS) PROGRAM BY AIR FORCE, DEPARTMENT OF DEFENSE, AND CONGRESS."

NAVS COMMAND FLYING UNITS: LIEUTENANT COLONEL JAMES D. SPENCE, A NAVIGATOR, ASSUMED COMMAND OF THE 3RD AIRBORNE COMMAND AND CONTROL SQUADRON (3ACCS) AT GRISSOM AFB, INDIANA ON 11 APRIL. COLONEL SPENCE WAS PREVIOUSLY CHIEF OF THE BATTLE STAFF SECTION OF THE ACCS. THE SQUADRON IS RESPONSIBLE FOR ASSUMING COMMAND OF SAC'S BOMBER AND MISSILE FORCE IN THE EVENT THE UNDERGROUND AND ALTERNATE COMMAND POSTS ARE DESTROYED.

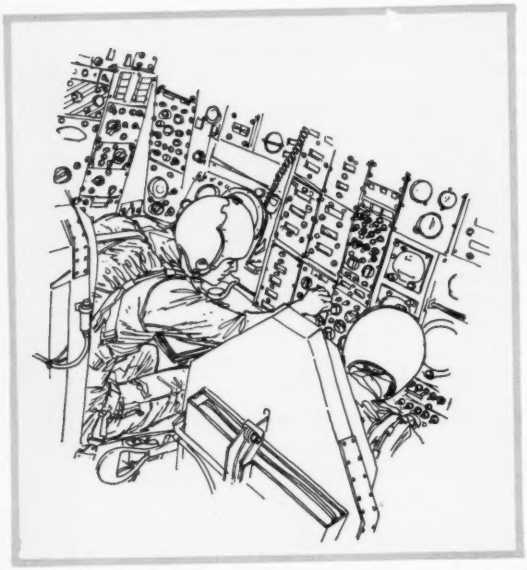
LIEUTENANT COLONEL CHARLES W. RICHEY, JR., ALSO A NAVIGATOR, ASSUMED COMMAND OF THE 328TH BOMBARDMENT SQUADRON AT CASTLE AFB, CALIFORNIA, ON 1 MAY. THE 328TH IS THE LARGEST FLYING SQUADRON IN SAC AND IS RESPONSIBLE FOR TRAINING B-52G AND B-52H CREWS. COLONEL RICHEY WAS PREVIOUSLY CHIEF OF OPERATIONS PLANS AT CASTLE.

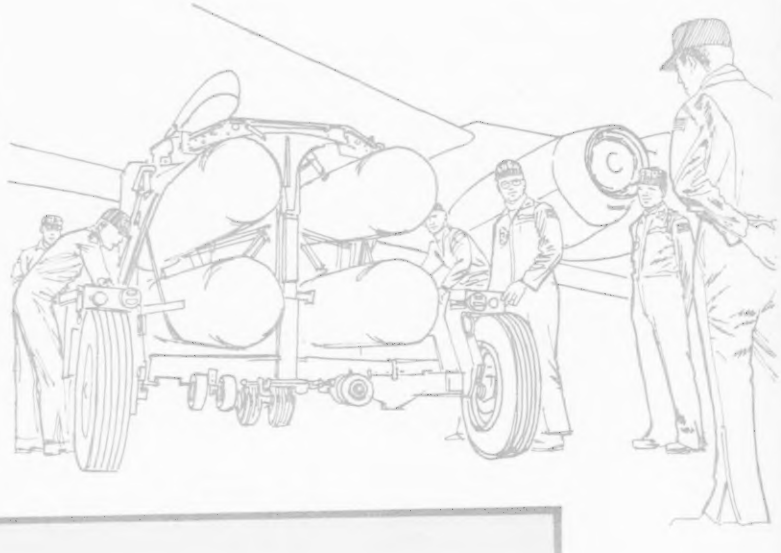
T-29 RETIRES: THE T-29 FLEW ITS LAST STUDENT NAVIGATOR TRAINING MISSION ON 5 MARCH, BRINGING TO A CLOSE OVER 20 YEARS OF HONORABLE SERVICE. ITS DUTIES HAVE BEEN ASSUMED BY THE MORE ADVANCED T-37 AND T-43 JET AIRCRAFT. THE FINAL T-29 FLIGHT FROM MATHER AFB, CALIFORNIA, OCCURRED ON 14 MARCH WHEN THE LAST BIRD WAS FLOWN TO DAVIS-MONTHAN AFB, ARIZONA. THOUGH THE T-29 IS NO LONGER ACTIVE IN NAVIGATOR TRAINING, THERE ARE T-29S AROUND THE WORLD PERFORMING OTHER DUTIES.

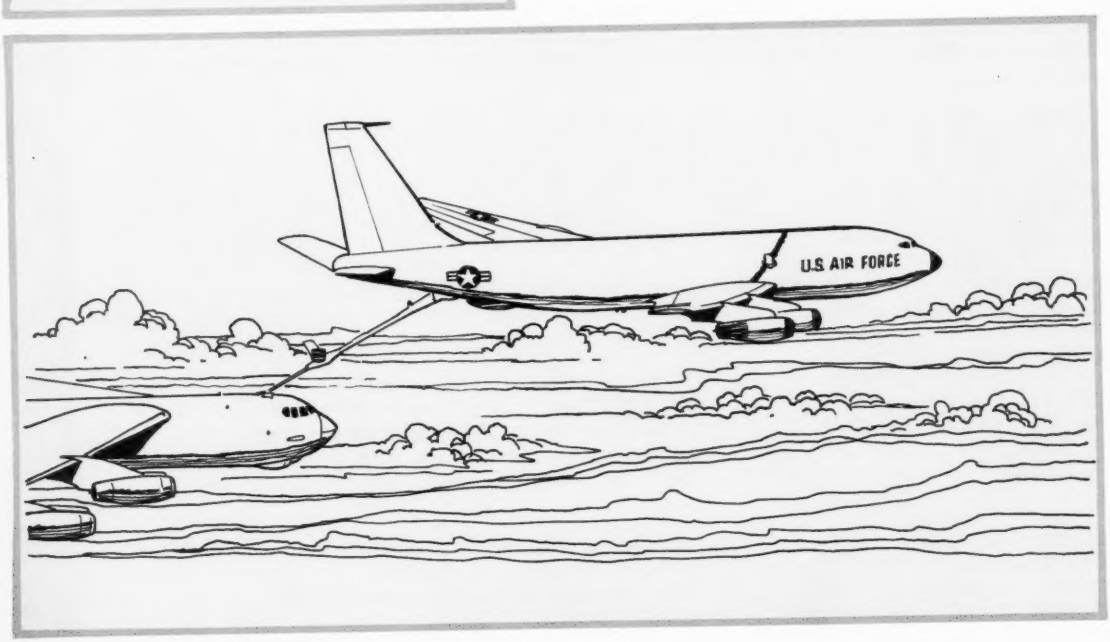
T45 TRAINING BEGINS: STUDENT TRAINING BEGAN IN THE T45 NAVIGATION SIMULATOR AT MATHER AFB, CALIFORNIA, ON 1 MAY. THE FIRST MISSIONS WERE GLOBAL MISSIONS TO INTRODUCE STUDENTS TO LORAN C FIXING PROCEDURES PRIOR TO THEIR FLIGHT MISSIONS. LOW LEVEL NAVIGATION IS SCHEDULED TO BE ADDED IN MID-JUNE AND OTHER MISSIONS WILL BE INCLUDED AS EQUIPMENT BECOMES AVAILABLE. THE T45 IS A SOPHISTICATED, COMPUTERIZED NAVIGATION TRAINER WHICH ALLOWS A STUDENT TO FLY AN INDEPENDENT MISSION ANYWHERE IN THE NORTHERN HEMISPHERE. NAVIGATION AIDS AVAILABLE INCLUDE RADAR, TACAN, VOR, CELESTIAL, PRESSURE PATTERN, INS, AND LORAN C. THE SIMULATOR WILL EVENTUALLY INCLUDE 52 STUDENT POSITIONS IN 13 COMPLEXES OF FOUR POSITIONS EACH.

NEW EDITOR: MAJOR LOUIS A. KUN, EDITOR OF "THE NAVIGATOR" SINCE JUNE 1974, HAS BEEN REASSIGNED TO THE 7TH MILITARY AIRLIFT SQUADRON, TRAVIS AFB, CALIFORNIA. MAJOR CARL H. WELLS, JR., CHIEF OF THE PROFESSIONAL DEVELOPMENT BRANCH, HAS ASSUMED THE JOB, ACTING AS INTERIM EDITOR.

☆ US Government Printing Office: 1975—689-428/3






U.S. AIR FORCE